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THE NATIONAL PARTS RETURN PROGRAM
Volume I: Independent Repair Facilities

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Kappa Systems, Inc.
1501 Wilson Blvd.
Arlington, Virginia 22209

Contract No. DOT HS-6-01433
Contract Amt. $90,970

DEPARTMENT OF
TRANSPORTATION
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July 1979
FINAL REPORT

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National Highway Traffic Safety Administration
Washington, D.C. 20590

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16. Abstract

The National Parts Return Program involves the voluntary submittal by independent automotive repair facilities of failed automotive components and information. The purpose of the program is to gather information on these components and failure reports to assist the NHTSA in identifying the existence of safety-related manufacturing defects in design, materials, construction or performance of motor vehicles and motor vehicle equipment. Under authority of the National Traffic and Motor Vehicle Safety Act of 1966, as amended, the NHTSA can require manufacturers to conduct safety defect recall remedy campaigns when it has been determined that a defect relating to motor vehicle safety exists. In addition, the information obtained from these parts and reports is valuable in preparing Federal Motor Vehicle Safety Standards.

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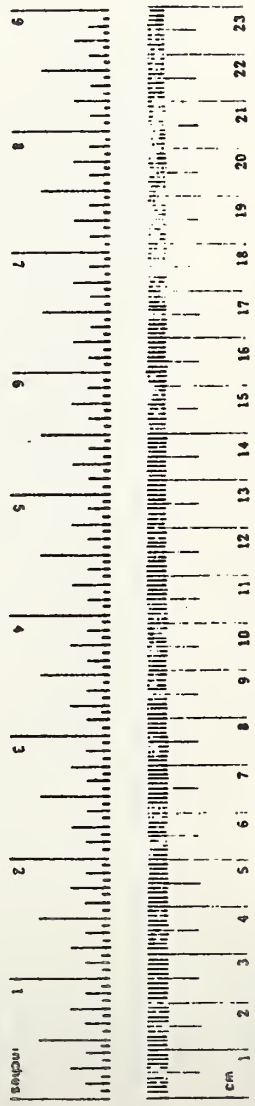
METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
	LENGTH			
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
	AREA			
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
	MASS (weight)			
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
	VOLUME			
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
	TEMPERATURE (exact)			
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

*1 in = 2.54 (exactly). For other exact conversions and more detailed tables, see NBS Misc. Publ. 286, Units of Weights and Measures, Price $2.25, SD Catalog No. C13.10:286.



Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
	LENGTH			
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
	AREA			
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
	MASS (weight)			
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
	VOLUME			
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
	TEMPERATURE (exact)			
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F

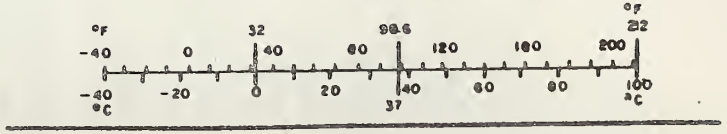


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TABLE OF CONTENTS

Volume 1

		Page
Terminology		1
Section 1:	PROGRAM OVERVIEW	3
	1.1 Introduction	3
	1.2 Program Methods	4
	1.3 Note on Contract Year 1979	4
Section 2:	PROGRAM MEMBERSHIP	6
	2.1 Overview	6
	2.2 Recruitment	6
	2.2.1 Sampling Requirements	6
	2.2.2 Incentives for Program Participation	7
	2.2.3 Enrollment Procedure	8
	2.3 Membership Characteristics	10
Section 3:	PROGRAM OPERATIONS	13
	3.1 Overview of Operational Procedures	13
	3.2 Data Collection and Materials	13
	3.2.1 The Data Collection Process	13
	3.2.2 The Data Collection and Processing Materials	15
	3.3 Data Management	25
	3.3.1 Parts and Information Processing	25
	3.3.2 Failure Analysis	33
	3.3.3 Manual Files	33
	3.3.4 Automated Filing Systems	34
	3.3.5 Monthly Reports	37
	3.4 PRP News	38
	3.4.1 Newsletter Production	38
	3.4.2 Motivational Effect	39
	3.4.3 Knowledge Transfer	40
	3.4.4 Attention Focus	41
	3.5 Administrator's Award	41
Section 4:	PROGRAM RESULTS	43
	4.1 Overview	43
	4.2 Program Contributions: Regional Differences	44
	4.2.1 Part Inputs	44
	4.2.2 Information Inputs	48

TABLE OF CONTENTS (Con't)
Volume 1

		Page
4.3	Component Classification	48
	4.3.1 Part Inputs	50
	4.3.2 Information Inputs	50
4.4	Model Year	50
	4.4.1 Part Inputs	50
	4.4.2 Information Inputs	54
4.5	Repair Shop Participation	56
	4.5.1 Membership Activity Levels	56
	4.5.2 Activity Rates	64
	4.5.3 Shop Types	67
4.6	Program Data Supporting NHTSA Investigations	69
Section 5:	CONCLUSIONS	71

EXHIBITS

		Page
Exhibit 1.1	Monthly Input Flow for Contract Year 1979	5
Exhibit 2.1	Cover Letter Sent to Newly Enrolled PRP Members	9
Exhibit 2.2	Regional Breakdown of the PRP Membership	11
Exhibit 2.3	PRP Regional Zones	12
Exhibit 3.1	PRP In-House Operations Activity Flow	14
Exhibit 3.2	PRP Flyer	16
Exhibit 3.3	PRP Wall-Size Poster	17
Exhibit 3.4	PRP Brochure	18
Exhibit 3.5	Component Identification Tag	20
Exhibit 3.6	Information Report Form	22
Exhibit 3.7	Telephone Contact Report	23
Exhibit 3.8	Log-in Sheet	24
Exhibit 3.9	Failed Part Data Sheet	26
Exhibit 3.10	Vehicle Owner's Analysis Coding Sheet	28
Exhibit 3.11	Certificate of Participation	29
Exhibit 4.1	Parts or Information Received from Active Shops - CY 79	59
Exhibit 4.2	Case Supported by the PRP: July 1978-June 1979	70

TABLES

Table 4.1	Part Inputs by Region: CY1976 - CY1979	45
Table 4.2	Hierarchical Ordering of Regional Part Inputs: CY1976 - CY1979	47
Table 4.3	Information Inputs by Region: CY1977 - CY1979	49
Table 4.4	Part Inputs by Component Classification: CY1977-CY1979	51
Table 4.5	Information Inputs by Component Classification: CY1977 - CY1979	52
Table 4.6	Part Inputs by Model Year: CY1977 - CY1979	53

TABLES (Con't)

		Page
Table 4.7	Information Inputs by Model Year: CY1977 - CY1979	55
Table 4.8	Repair Shop Activity by Region: CY1976 - CY1979	57
Table 4.9	Hierarchical Ordering of Regional Repair Shop Activity: CY1976 - CY1979	65
Table 4.10	Hierarchical Ordering of Regional Ratios of Part Inputs Per Active Repair Shop: CY1976 - CY1979	66
Table 4.11	Participatory Differences Between Four Categories of Repair Shops: CY1977 - CY1979	68

APPENDIX: Notes on Statistical Analysis

1. Introduction to the Notes

2. Statistical Formulas

3. Notes

TERMINOLOGY

PARTICIPANT: Any person or establishment that has contributed to the PRP.

PROGRAM MEMBER or ENROLLEE: An establishment which satisfies the requirements for membership and agrees to participate in the Parts Return Program (PRP) on a voluntary basis.

REPAIR SHOP: An establishment enrolled in the PRP which operates mainly as an independent repair facility.

INPUT or CONTRIBUTION: A returned part or information report concerning a safety-related automotive defect.

PART or ACTUAL PART: A component or sub-assembly found in automobiles.

ASSEMBLY: A system of related parts. For example, a brake drum and a brake shoe are considered two parts, but one assembly.

RESPONSE: A contact from a PRP member with at least one input involved. Could be a mailbag (regardless of the number of parts), letter or telephone call.

INFORMATION or INFORMATION-ONLY input: A PRP input record for which no part was submitted.

ACTIVE PARTICIPANT or ACTIVE ESTABLISHMENT: A PRP member who has contributed a part or reported information about a defective part during a contract year.

ACTIVITY LEVEL: The percentage of members within a group that were active.

ACTIVITY RATE: The average number of inputs (or responses) per active establishment within a membership group.

ODI DATA INFORMATION SYSTEM (DIS): A computerized data retrieval system operated for the Office of Defects Investigation. System includes failure data from Vehicle Owners, Manufacturer Technical Service Bulletins, engineering analysis and survey data, and data collected through the PRP.

PART NUMBER: A unique ODI/DIS number assigned to a part or information report. In some cases, the part number is assigned to related parts, i.e., those that are a part of a larger assembly that failed or where the primary failure in one part caused a secondary failure in another.

RECORD: ODI/DIS file description of parts received through the PRP. Usually stated in group of five to six punched cards (out of a possible eight).

SHOP IDENTIFICATION NUMBER: An eight-digit number representing a PRP participant. The first five digits are the PRP member's zip code and the last three represent a unique sequential number within the member's state. Shop ID numbers for Expansion Study members are preceeded by an F for a fleet, a D for a dealership, and a P for an automotive parts supplier.

Section 1

PROGRAM OVERVIEW

1.1 INTRODUCTION

Under the authority of the National Traffic and Motor Vehicle Safety Act of 1966, the National Highway Traffic Safety Administration (NHTSA) is delegated the responsibility of defects investigation and the monitoring of recall campaigns involving motor vehicles and motor vehicle equipment. In order for the NHTSA to fulfill its responsibility, new information on safety-related defects in the design, construction, materials and performance of motor vehicles and motor vehicle equipment is continuously needed.

As part of its effort to obtain this information, the NHTSA initiated the Parts Return Program (PRP) in 1971. KSI has assisted the NHTSA in the operation and maintenance of the PRP since CY 1976*. The PRP operates on the principle of soliciting the voluntary nationwide support of independent automotive repair establishments, new car dealers, high mileage fleets and automotive parts suppliers who, during the course of their everyday business activity, uncover and identify potential safety-related problems in automotive components. Program members submit actual failed parts or information on the failure to the NHTSA via Kappa Systems, Inc. (KSI).

This final report is comprised of three volumes. Volume I primarily discusses the activity of independent repair facilities enrolled in the PRP during the period of 1 July 1978 through 30 June 1979. Some past highlights of the PRP since CY 1976 are also included. Volume II describes and evaluates the feasibility study on the expansion of the PRP to include new car dealers, high mileage fleets and automotive suppliers nationwide. Volume III contains PRP Newsletters for 1979 as well as monthly summaries of parts received.

* CY 1976 refers to the contract year from July 1975 through June 1976.

1.2 PROGRAM METHODS

Various groups within the automotive industry are represented in the total enrollment of the PRP. The membership includes general repair garages, specialty shops (i.e., brakes, front end tires) service stations, new car dealers, fleets and automotive parts suppliers. When members remain inactive for a period of time, they are deleted from the program; new facilities are enrolled to take their place. These establishments are nationally distributed and are divided into ten separate geographic regions according to zip codes. They are selected randomly within regions and initially contacted by KSI through telephone calls and/or personal visits.

Each of these program members is supplied with pre-addressed and postage-paid canvas mailbags, as well as failed part identification tags with protective covers in order to provide an efficient means of allowing the failed part to be returned to the NHTSA. Members are also supplied with information report forms to provide information on safety-related defects in components which, for various reasons, cannot be returned.

KSI puts the actual failed part into storage after transcribing relevant data onto a failed part data sheet and computer input record format. Monthly reports are submitted to the NHTSA and parts of interest are forwarded for analysis. The NHTSA then decides which parts are to be retained based upon active investigations being carried out by the Office of Defects Investigation.

1.3 NOTE ON CONTRACT YEAR 1979

Exhibit 1.1 indicates total parts received for contract year 1979. The contract was extended for a two-month period, through July and August 1979. Parts received for the extension period are included in Volume III. They are not included in the CY 79 tabulations. In addition, "CY 79" refers, throughout this report, to the period from 1 July 1978 through 30 June 1979.

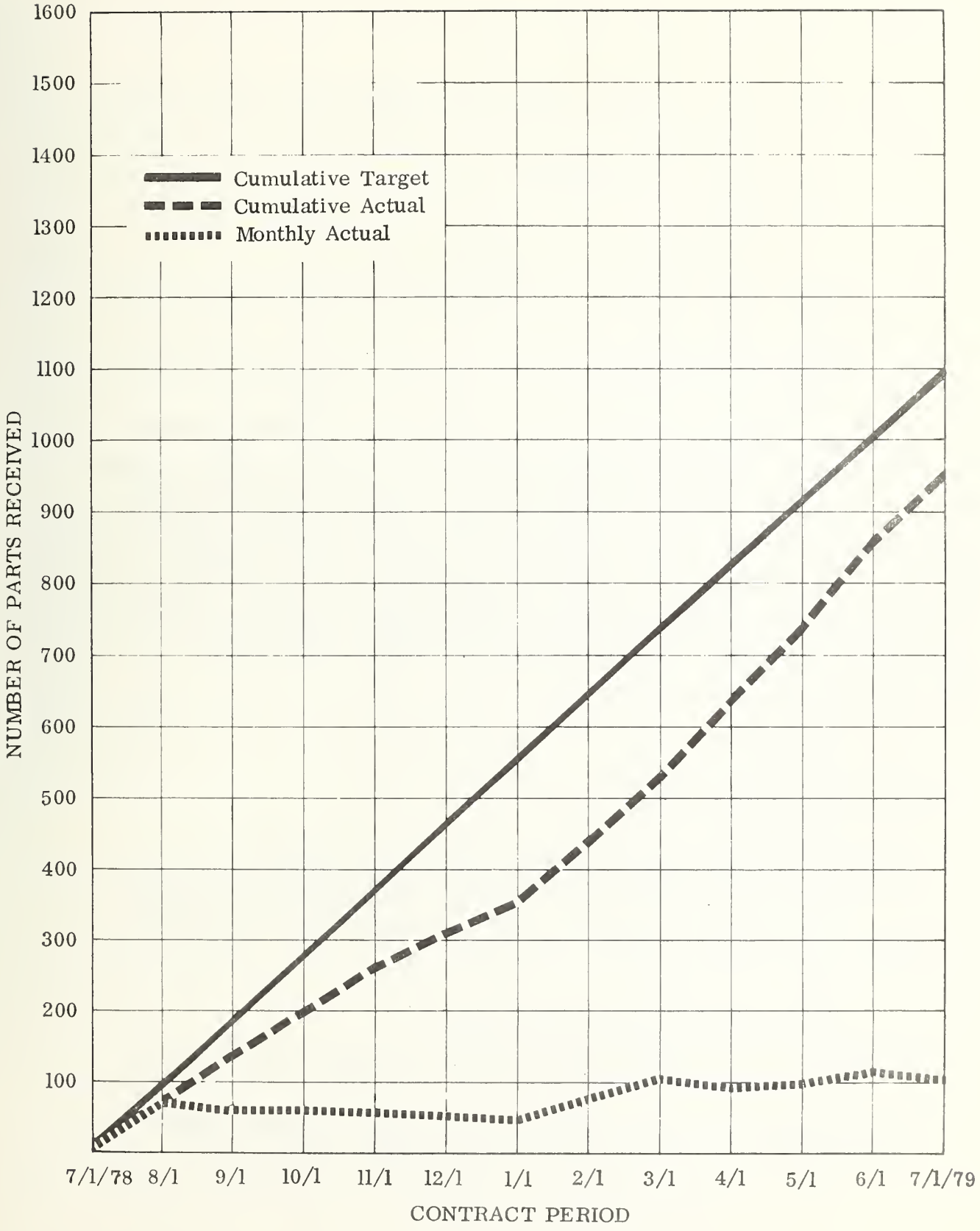

1600
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
NUMBER OF PARTS RECEIVED
Cumulative Target
Cumulative Actual
Monthly Actual
7/1/78
8/1
9/1
10/1
11/1
12/1
1/1
2/1
3/1
4/1
5/1
6/1
7/1/79
CONTRACT PERIOD

Exhibit 1.1

Section 2

PROGRAM MEMBERSHIP

2.1 OVERVIEW

This section will focus on recruitment requirements, enrollment techniques, and membership characteristics pertaining to independent repair facilities. The PRP membership has been comprised of independent repair facilities since the Program's inception in 1971. During CY1978, the PRP Expansion Study was initiated to investigate the feasibility of including in the membership new car dealers, high mileage fleets and automotive parts suppliers. The PRP Expansion Study membership and its activities are discussed primarily in Volume II of this report.

2.2 RECRUITMENT

2.2.1 Sampling Requirements

There are several sampling criteria which are considered in the recruitment process of independent repair facilities. These requirements enable us to obtain the maximum amount of representative information from around the nation.

The sampling requirements are as follows:

1) Shops must be independent of any motor vehicle or motor vehicle equipment manufacturer;

2) Shops must be engaged primarily in the repair of cars and light trucks;

3) One of four shops must have a towing service;

4) Shops must have a minimum of two service bays; and

5) 10% of all shops must be engaged primarily in the repair of imported vehicles.

2.2.2 Incentives For Program Participation

Since the PRP relies on its membership to contribute on a voluntary basis, it is important to address the various existing incentives that relate to an establishment's willingness to be enrolled and to participate actively. That is, why do shops bother to contribute? How do they benefit?

A major incentive for voluntary participation is probably the member's interest in being helpful and, hence, we assume the establishment's manager experiences a feeling of self-fulfillment following a contributive gesture. Therefore, KSI is careful to acknowledge each set of contributions with a thank-you letter and further encouragement. When members contribute information over the telephone, we are often able to establish some degree of rapport which also helps to influence their altruistic natures. In addition, if the contribution is particularly worthwhile, it is mentioned in the monthly PRP News (see Section 3.4) which is distributed nationwide.

National recognition may also affect related motives such as pride and professional achievement. Under the realization that official acknowledgements of member's active participation could directly influence their pride and indirectly affect their customer relations and financial concerns, the PRP makes appropriate use of two material rewards: a Certificate of Participation (see Section 3.2.2) and an Administrator's Award (see Section 3.5). Both are enclosed in an attractive frame. The Certificate of Participation is awarded following the receipt of a member's first contribution of the contract year and the Administrator's Award (the actual award being a "Certificate of Appreciation" signed by the NHTSA Administrator) is given to a select group of shops that were most valuable to the PRP during the contract year.

Another reason shops may be willing to participate in the PRP is to gain knowledge about safety-related automotive parts. The PRP News serves as an important vehicle in satisfying these educational motives.

2.2.3 Enrollment Procedure

Independent repair facilities which are identified as prospective members are initially contacted by telephone and explained the functions of the program and its benefits to them as members and to the nation as a whole. If they agree to participate, they are sent an enrollment package, which includes a mailbag, five component identification tags and five information report forms (see Section 3.2.2 for descriptions of these materials). Also in the enrollment package, the establishments are sent a current PRP newsletter (see Section 3.4) and a cover letter which welcomes them officially into the PRP and encourages them to begin contributing parts or information (see Exhibit 2.1). Regardless of their activity, the shops are sent the monthly newsletter regularly and are occasionally sent flyers, brochures or posters as reminders of our interest in their active participation.

U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION

PARTS RETURN PROGRAM

REPLY TO:
U.S. Department of Transportation
c/o KAPPA Systems, Inc.
1501 Wilson Blvd.
Arlington, Va. 22209
(703) 527-4500

We take this opportunity to welcome you to our National Parts Return Program team. We believe this program to be a valuable tool in uncovering potential safety related defects in motor vehicles.

We have enclosed with this letter your "Shop Kit" which includes the following:

1. One pre-addressed and postage free failed part mailbag.
2. Five (5) failed part identification tags and their protective covers.
3. A recent Defect Investigatory Cases Report.
4. One page bulletins requesting failed parts.
5. Five (5) pre-addressed and postage free Information Reporting cards.

A current PRP Newsletter is included for your review. We will send you a new edition monthly.

The procedure to follow in sending a suspect failed part is as follows. Once the part has been removed from the vehicle record the name and address of the owner on the reverse side of the failed part identification tag. Once this task has been completed, fill out the front of the tag identifying the part completely. Please record the results of your visual inspection of the part under failure description.

Prior to attaching the failed part tag to the part, place the tag in its protective cover and seal the cover. This will prevent grease and oil from the part ruining the recorded information. Once the part with completed tag has been placed in the mailbag, secure the bag by tying the strings. The bag is then ready for mailing.

The "Information Reporting" cards are to be used when the actual part can not be sent. These cards are pre-addressed and postage free. Just fill in available information in and put in mail.

We look forward to your becoming an active participant in this public safety project by sending us a failed part. As soon as we receive your first mailbag with a failed part we will send you a framed "Certificate of Participation" highlighting your shop as an active participant in supporting safety on our highways.

Very truly yours,

Martin J. Lowery
Project Manager

Exhibit 2.1 Cover Letter Sent to Newly Enrolled PRP Members

2.3 MEMBERSHIP CHARACTERISTICS

At the end of CY1979, the PRP membership consisted of 1812 independent repair facilities and 663 Expansion Study members. Of the 1812 repair shops, 66.9% were general repair facilities (other than service stations), 14.6% were specialty repair facilities (i.e., brake, tire, electrical, transmission, alignment, or other specialized services), and 18.5% were service stations. The Expansion Study members are described in Volume II.

Currently, the distribution of enrolled shops across the ten regions varies from a low of almost 5% regional share of total PRP membership to a high of 14% (see Exhibit 2.2). Exhibit 2.3 illustrates the breakdown of the ten PRP regions within the continental United States. Ideally, each region should have a total membership which is proportional to its share of service facilities nationwide, as determined by the U.S. Bureau of the Census. The PRP policy is to replace inactive (i.e., non-contributing) members with new establishments which are selectively enrolled in order to keep the total membership fairly representative.

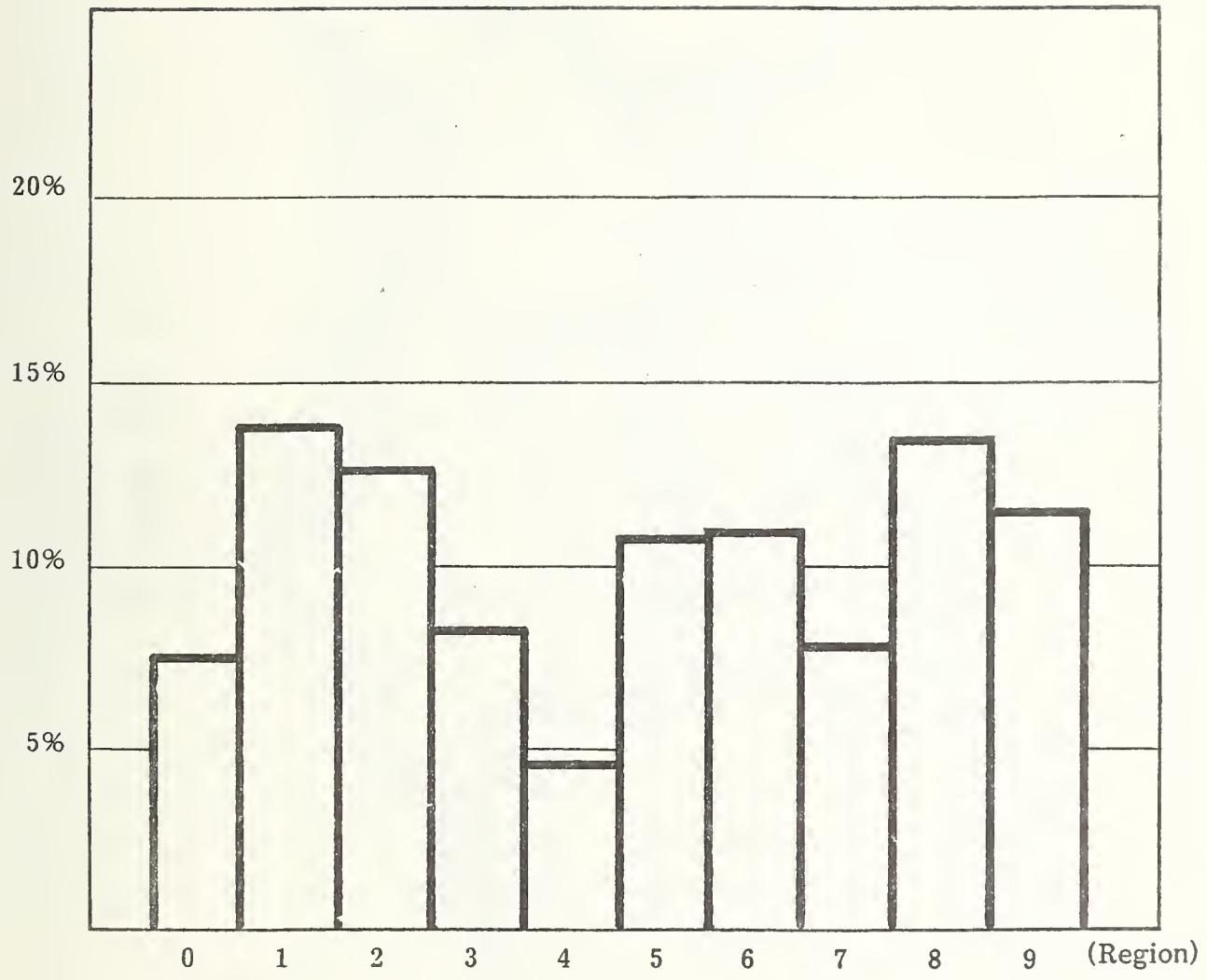


Exhibit 2.2 Regional Breakdown of the PRP Membership

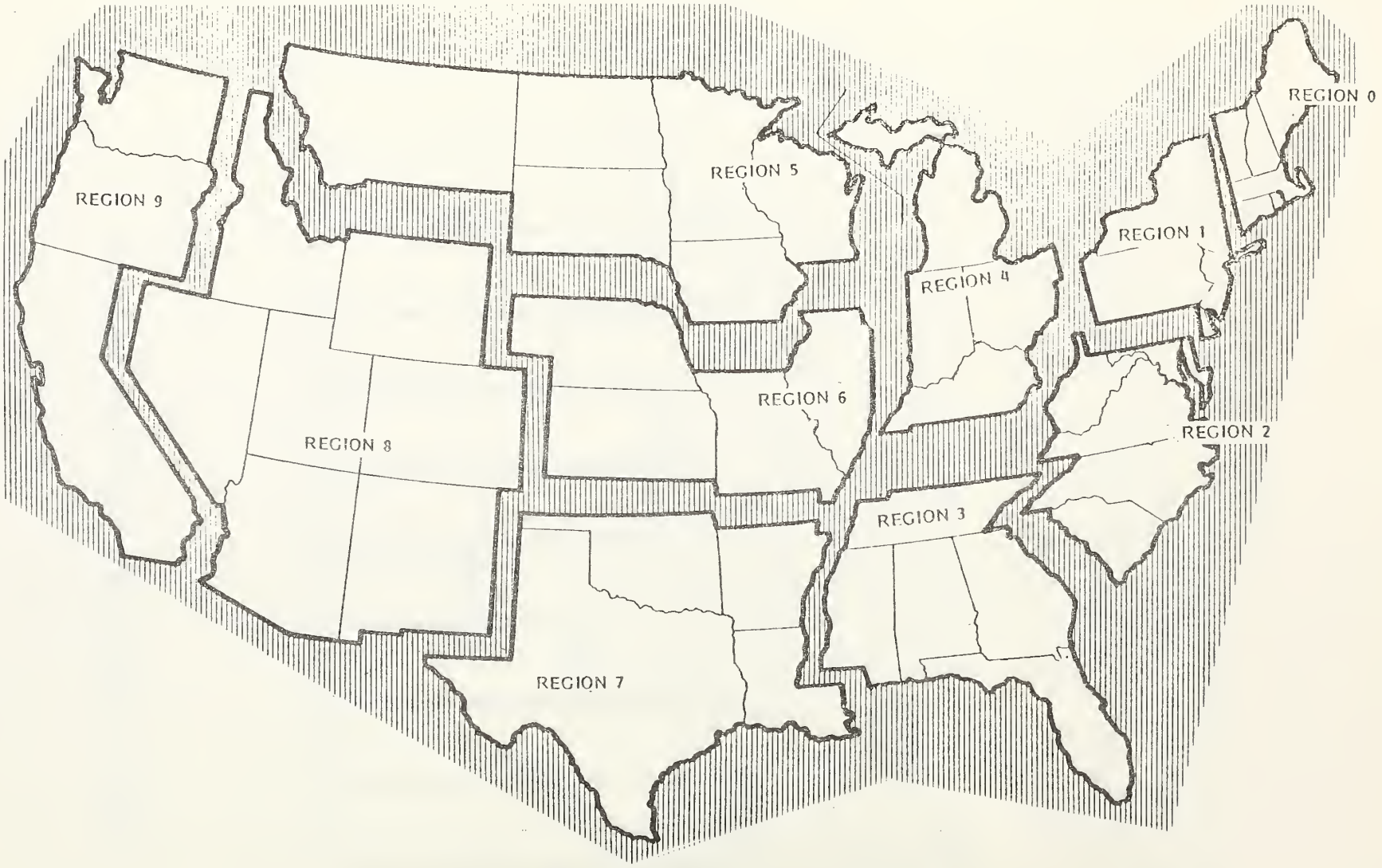


Exhibit 2.3 PRP Regional Zones

Section 3

PROGRAM OPERATIONS

3.1 OVERVIEW OF OPERATIONAL PROCEDURES

Once an establishment has been enrolled into the PRP, KSI is concerned with three major operational functions: 1) data collection, 2) data management, and 3) the production of the PRP Newsletter. Data management operations include parts and information processing, failure analysis, updating manual and automated files, and producing monthly reports. An in-house activity flow diagram reflecting the above basic functions is illustrated in Exhibit 3.1. These operations are described in the following sub-sections.

3.2 DATA COLLECTION AND MATERIALS

3.2.1 The Data Collection Process

Upon the receipt of the enrollment package, new PRP members are able to begin contributing either defective automotive parts or information about them. They will have in their possession a mailbag within which they can send one or more parts, five tags to identify the failed part components, and five information report forms if they are unable to send off the actual parts.

When an establishment makes a contribution, KSI responds with an acknowledgement letter thanking them for their input and resupplies their material inventory to a total of three mailbags and a minimum of five components identification tags and five information report forms. If the contribution was the first one of the contract year, KSI also sends the member a Certificate of Participation.

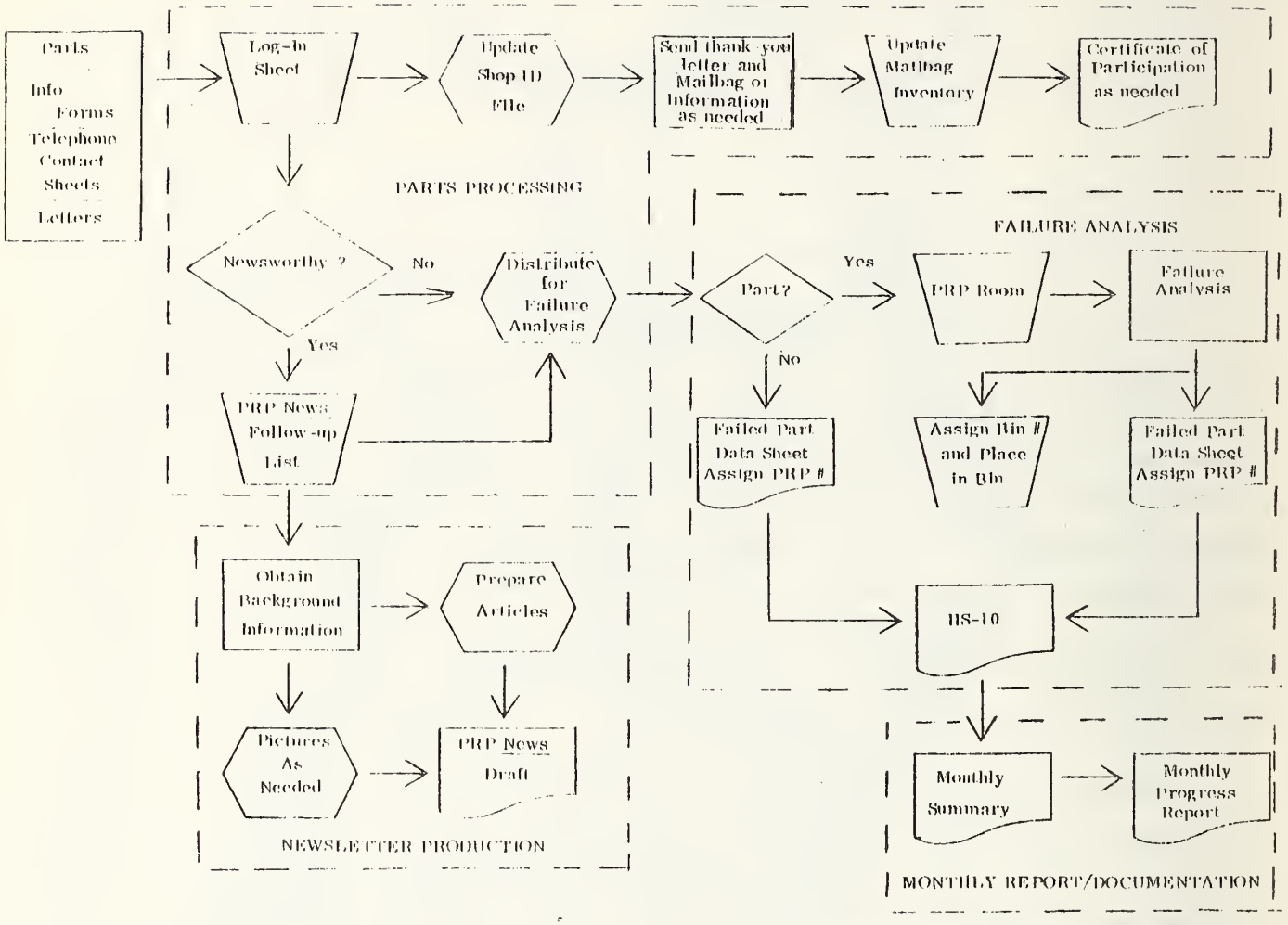


Exhibit 3.1 PRP In-house Operations Activity Flow

Regardless of whether or not a shop contributes anything at all during the year, it continues to receive the monthly PRP News. For those members who do not actively participate, the newsletter serves to at least remind them of their membership in the Program and may motivate them to respond with a contribution. To further motivate the enrolled establishments, KSI also sends them other reminders. During the past contract year, we've sent members basic PRP information and requests for contributions in the form of a flyer (Exhibit 3.2), a giant wall-size poster (a reduced copy of the 40"x30" poster is shown in Exhibit 3.3) and a brochure (Exhibit 3.4).

3.2.2 The Data Collection and Processing Materials

The various items used by KSI and member shops in the collection of parts and information relating to potential safety defects are described below:

Mailbags

Mailbags are used by the shops to forward failed automotive components to the NHTSA via KSI. These postage-paid canvas mailbags are pre-addressed to KSI. They are approximately 13 1/2" x 20" which is a sufficient size in which to place a defective vehicle component. After a mailbag is received by the PRP, it is laundered and reissued, though not necessarily to the same shop. When a shop becomes active in the PRP, its mailbag inventory is increased and maintained at three bags. Each bag has a unique bag number for the purpose of inventory control.

Component Identification Tags

The failed part component identification tags (HS Form 396) are used by the shops to identify the returned components (see Exhibit 3.5). The shop completes the tag before the component is actually submitted to the PRP. It is secured to the component. Each tag provides the following information: component description; failure description; component removed by (initials); date component removed; vehicle model and model year; vehicle mileage; component mileage; and vehicle owner's name and address. Each tag has a plastic transparent protective cover to prevent it from being obliterated by

SUPPORT HIGHWAY SAFETY

The Parts Return Program

JOIN THE NATIONWIDE EFFORT TO PROMOTE HIGHWAY SAFETY through the Parts Return Program. The active participation of independent repair shops gives the program a valuable avenue towards automotive safety research through the eyes of some 2000 facilities across the country. The defective components and information submitted to the PRP as well as your direct contact with the vehicle owners and operators provides us with an even greater potential for discovering the origins of safety related defects.

During the past year, 12% of the independent repair shops contributed 100% of the parts and information received in the PRP. If the remaining 88% of the membership would spend just five minutes for highway safety and send us one part or information input, our effective campaign to combat automotive component defects would more than double. We are aware of your requirement to return many parts for warranty reimbursement, core charges and customer requests. For this reason we have supplied all of our program members with information reporting forms which can be submitted in lieu of the actual part. Simply fill out the form with pertinent information concerning the part, recurrent problems you have noticed or any suggestions you or your staff may have and drop it in the mail or better yet, give us a call (collect) at (703) 524-0900 and pass on your suggestions and experiences. What better way to promote highway safety and automotive defect research than active participation in the National Parts Return Program. Highway safety is a commitment we all must make. Make yours through the Parts Return Program.

Exhibit 3.2 PRP Flyer

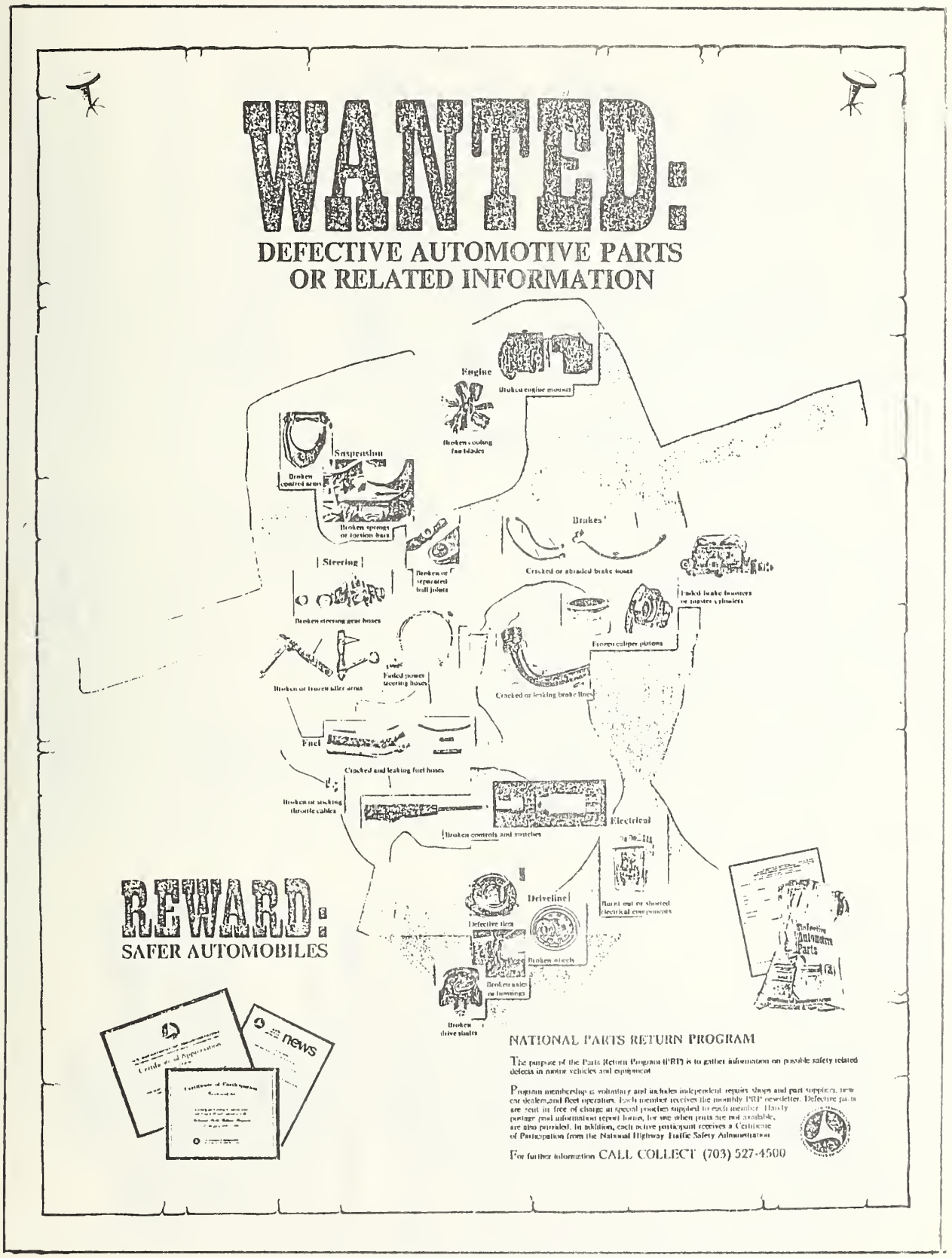

WANTED:
DEFECTIVE AUTOMOTIVE PARTS
OR RELATED INFORMATION
Engine
Broken engine mounts
Broken cooling fan blades
Suspension
Broken control arms
Broken springs or torsion bars
Brakes
Broken or separated ball joints
Cracked or abraded brake hoses
Failed brake boosters or master cylinders
Steering
Broken steering gear boxes
Frozen caliper pistons
Broken or frozen idler arms
Failed power steering hoses
Cracked or leaking brake lines
Fuel
Cracked and leaking fuel hoses
Broken or sticking throttle cables
Broken controls and cables
Electrical
Burnt out or shorted electrical components
Driveline
Defective U-joints
Broken shafts
Broken axles or bearings
Broken drive shafts
REWARD:
SAFER AUTOMOBILES
news
Defective Automotive Parts
NATIONAL PARTS RETURN PROGRAM
The purpose of the Parts Return Program (PRP) is to gather information on possible safety related defects in motor vehicles and equipment.
Program membership is voluntary and includes independent repair shops and part suppliers, new car dealers, and fleet operators. Each member receives the monthly PRP newsletter. Defective parts are sent in free of charge in special pouches supplied to each member. Handy postage paid information report forms, for use when parts are not available, are also provided. In addition, each active participant receives a Certificate of Participation from the National Highway Traffic Safety Administration.
For further information CALL COLLECT (703) 527-4500

Exhibit 3.3 PRP Wall-size Poster

Typical Failures

The PRP is interested in all parts and equipment which may be defective through design, materials or manufacturing such that the malfunction of that part or piece of equipment could affect the safety of the operator.

The following list offers typical examples of the kinds of information the PRP is looking for:

Bent Items

- Backing Plates
- Brake Shoes
- Brake Pedals
- Suspension Systems
- Ball Joint Assemblies

Cracked or Broken Items

- Wheel Cylinders
- Brake Drums
- Disc Brake Rotors
- Brake Shoe Welds
- Pitman Arms
- Idler Arms
- Coil Springs

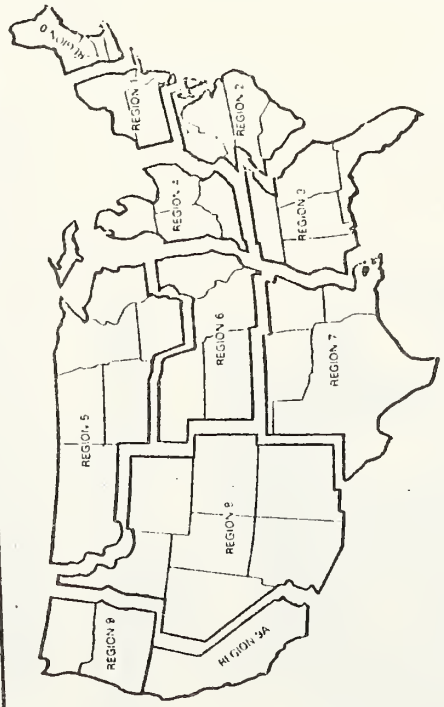
Items Worn By Rubbing

- Brake Hoses
- Brake Lines
- Power Steering Hoses

Malfunctioning Items

- Master Cylinders
- Power Steering Pumps

March 1979



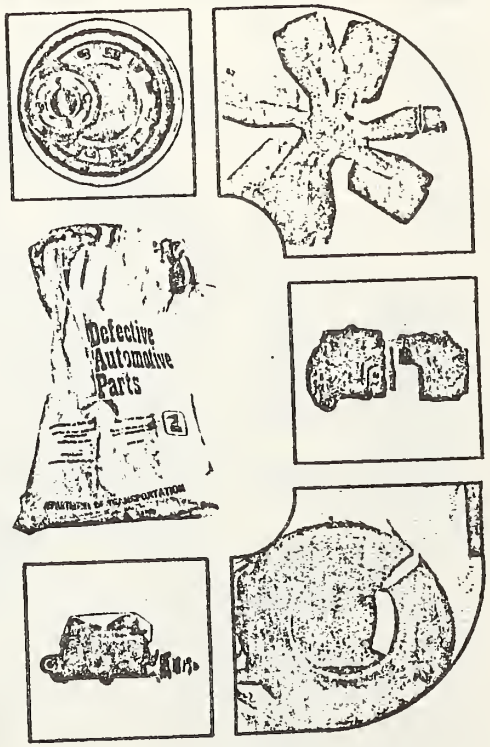
The Parts Return Program Regional Network

For further information about the PRP, write or call:

KAPPA SYSTEMS, INC.
1501 Wilson Boulevard
Arlington, Virginia 22209
(703) 524-0900

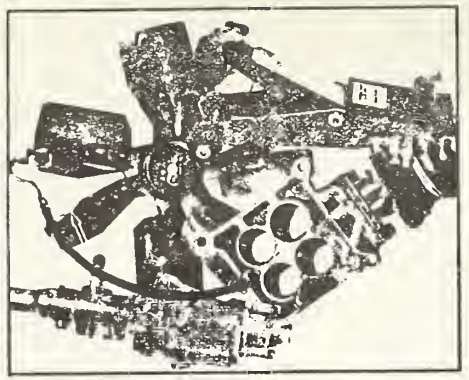
The National Parts Return Program

U.S. Department of Transportation
National Highway Traffic Safety Administration



Promoting active industry concern for motor vehicle safety

Exhibit 3.4 PRP Brochure



Background

Since 1966, under authority of the National Traffic and Motor Vehicle Safety Act, the U.S. Department of Transportation's National Highway Traffic Safety Administration(NHTSA) has been responsible for identifying safety-related defects in the design, materials, construction and performance of motor vehicles and motor vehicle equipment. In order to adequately fulfill this responsibility, new information on alleged problems is always needed. One important "behind the scenes" activity which assists this effort is the National Parts Return Program.

Begun in 1971, the National Parts Return Program (PRP) has relied upon the concern of individuals within the automotive service industry for motor vehicle and highway safety. All around the country, service establishments have been asked to keep an eye out for special problems in the vehicles which they service and repair on a day-to-day basis. The information submitted on such vehicles is extremely helpful to the NHTSA in providing an early warning indication of safety-related problems.

How Does the Program Work?

Every member of the Parts Return Program receives an introductory packet of information upon enrolling in the program. Contained in that packet is a postage pre-paid canvas mailbag, a supply of information reporting forms and program instructions.

When a member notes a problem in a vehicle which is being serviced, and when that problem could affect the safe operation of the vehicle, the PRP would like to hear about it. If the failed part in question does not need to be returned to the manufacturer for purposes of warranty reimbursement, the canvas mailbag should be used to forward the part itself to the National Highway Traffic Safety Administration. If the part cannot be forwarded, the information regarding its failure characteristics and information on the vehicle from which it was removed should be sent via the postage pre-paid information reporting form.

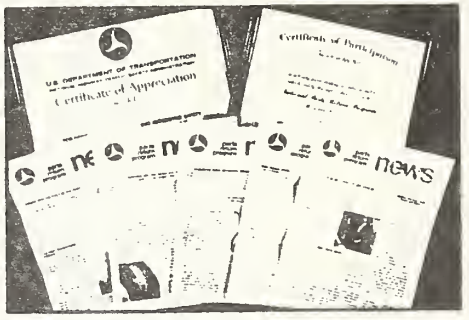
As parts and information are received, a daily step-by-step procedure is begun. Each part is logged-in, with information noted on the contributor, the date received, the vehicle from which the part was removed and the type of failure involved. Automotive analysts then assign each component a unique identifying number and review the problem in order to further specify the type of failure and the probable cause. Each record is then stored on the NHTSA Office of Defects Investigation computer file along with vehicle owner complaint letters and manufacturer service bulletins.

Members receive a Certificate of Participation when they become active participants for a particular program year. The certificate is framed and offers the opportunity for a service facility to publicly proclaim its concern for vehicle and highway safety.

Who Can Participate?

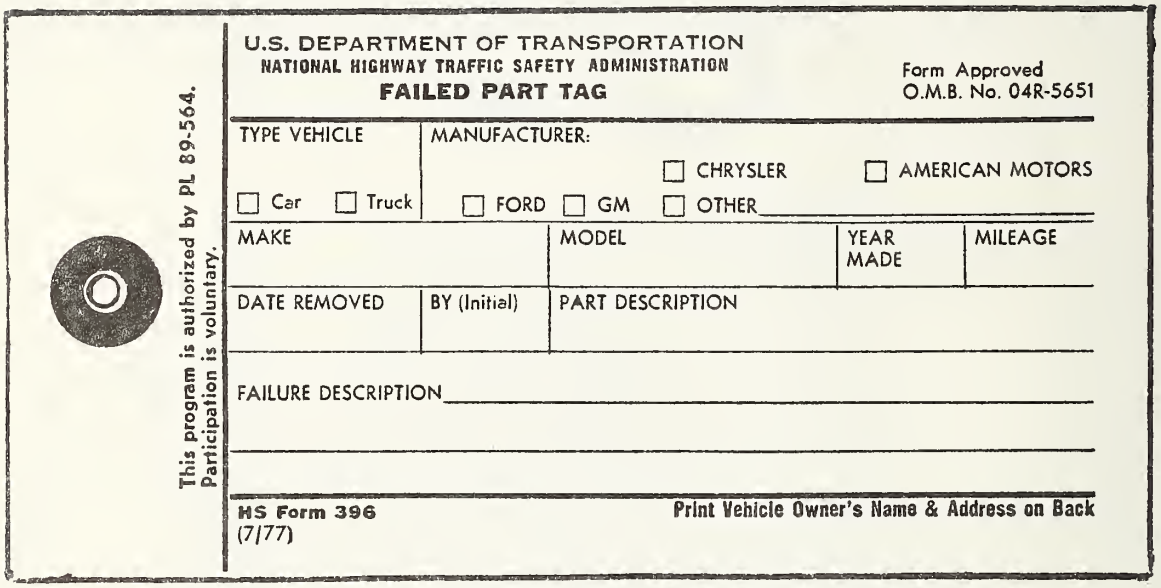
The Parts Return Program is open to all members of the automotive service industry new car dealers, independent repair facilities, automotive parts suppliers and high mileage fleet maintenance departments. Membership is voluntary and requires only a desire to actively promote motor vehicle safety. There are currently 2,600 members of the PRP, representing all segments of the service industry. New members are always welcome.

Each member receives a monthly newsletter, the PRP *News*, offering the latest information on problems arising in the field as well as special items of interest on highway safety and NHTSA activities.



How Can I Participate?

Any service industry establishment interested in participating in the Parts Return Program should contact the National Highway Traffic Safety Administration through the program coordinator listed on the back of this brochure.



This program is authorized by PL 89-564.
Participation is voluntary.

U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
FAILED PART TAG

Form Approved
O.M.B. No. 04R-5651

TYPE VEHICLE	MANUFACTURER:		
☐ Car ☐ Truck	☐ CHRYSLER ☐ FORD ☐ GM ☐ AMERICAN MOTORS ☐ OTHER_____		
MAKE	MODEL	YEAR MADE	MILEAGE
DATE REMOVED	BY (Initial)	PART DESCRIPTION	

FAILURE DESCRIPTION_____

HS Form 396
(7/77)

Print Vehicle Owner's Name & Address on Back

Exhibit 3.5 Component Identification Tag

liquids or dirt from the failed part. Each tag is marked with the shop's identification number to identify the contributor of each part received by KSI.

Information Report Forms

The information report forms (HS Form 394) are used by the shop to record information on a safety-related defective component when the actual part cannot be submitted to the PRP (see Exhibit 3.6). These postage-paid forms are postcard sized and pre-addressed to KSI. Each form provides the following information: submittor; date failure noted; failure description and result; vehicle model and model year; vehicle mileage; component description; component mileage; vehicle owner's name and address; and whether component is original equipment manufacturer or replacement. The shop identification number is recorded on each form to identify the contributor of the information. The use of these forms was first initiated during CY1978.

Telephone Contact Report

Telephone Contact Report sheets are used by the PRP to record data reported by telephone by participating shops or other interested parties (see Exhibit 3.7). The report enables the PRP to obtain pertinent data on the participating shop, the vehicle, the component, the failure and the vehicle owner. It is used for both initial contacts and follow-up contacts. After the form is completed, it is attached to the failed part data sheet (discussed below) for review. The Telephone Contact Report was first devised in CY1977 and modified in both CY1978 and CY1979.

Log-In Sheet

The log-in sheets are used daily by the PRP to log-in parts and information inputs as they are received from participating members (see Exhibit 3.8). The sheet allows the PRP to record data such as the date the part or information report is received; the shop's unique identification number; the shop name and address; the activity status of the shop; the type of input received (part, information card, telephone contact, letter); and vehicle and component information. The log-in sheet is also used for noting which shops need mailbags

U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION

O.M.B. No. 004–R5651
Approval Expires
August 1982

PARTS RETURN PROGRAM—INFORMATION REPORT

(To be completed when parts are not available)

This program is authorized by PL 89–564. Participation is voluntary

SUBMITTED BY	DATE	P

VEHICLE

MAKE _____

MODEL _____

YEAR _____ MILEAGE _____

OWNER'S NAME & ADDRESS (if applicable)

_____

_____

_____

COMPONENT

MANUFACTURER _____ MILEAGE _____

DESCRIPTION _____ PART NUMBER _____

☐ NEW ☐ REBUILT

Fold

FAILURE DESCRIPTION & RESULT

_____

_____

_____

_____

_____

_____

_____

_____

_____

HS Form 394 (7/77)

Exhibit 3.6 Information Report Form

PARTS RETURN PROGRAM
Telephone Contact Report

PRP# P_____ _____ _____ Initial Contact
Shop ID Number

Date _____ _____ Follow-up Contact

Shop Name _____ Contact Name _____

Shop Location _____ Phone No. ( ) _____
City State

VEHICLE DATA

Manufacturer _____ Model Year _____

Model _____ Mileage _____ VIN # _____

COMPONENT DATA

Component _____ Original or Replacement _____

Part ID No. _____ Component Mileage _____

FAILURE DATA

Cause of Failure _____

_____

_____

Vehicle in Motion? _____ Fire? _____ Loss of Control? _____

Accident _____ How Occurred _____

Injuries _____ #Fatalities _____ Property Damage $_____

How was failure diagnosed? Symptoms? _____

_____

Has shop seen similar failures on other vehicles? _____

VEHICLE OWNER DATA

Name _____ Phone No. ( ) _____

Street Address _____

City _____ State _____ Zip _____

Exhibit 3.7 Telephone Contact Report

Date Rcvd	Shop ID #	Shop Name/ Address	Status	Needs Cert.	Input Type	Needs Bag	Vehicle Information	Component

Exhibit 3.8 Log-In Sheet

or certificates (discussed below). The log-in sheet has been modified in CY1979.

Failed Part Data Sheets

The failed part data sheets are used by KSI analysts to record and expand pertinent information on the failed part (see Exhibit 3.9). Information report forms, telephone report forms, photographs and other related correspondence are attached to these documents. A failed Part Data Sheet is filled out for each part or information input received. Modifications were made to the form during CY1977.

Coding Sheets

The Vehicle Owner's Analysis Coding Sheet (HS 10) is used to transcribe data from the Failed Part Data Sheets (see Exhibit 3.10). The data gathered through the PRP is entered and stored in the ODI Data Information System (DIS) Vehicle Owner Letter File. An HS-10 Form is completed for every failed part data sheet. The HS-10 Form was revised in CY1977.

Certificate of Participation

Shops that submit their first failed part or item of information for the fiscal year receive two framed Certificates of Participation (see Exhibit 3.11). These graphically produced documents are both eye-catching and appealing. The certificate used during CY1979 is printed in black and red with the shop name handlettered. The design of the certificate for each year is significantly different from the previous year.

3.3 DATA MANAGEMENT

3.3.1 Parts and Information Processing

All parts and "information only" inputs to the PRP follow a specific procedure from the time they are received to the time they are put into permanent storage.

PARTS RETURN PROGRAM
FAILED PART DATA SHEET

BIN NO. _____ PRP NO. P _____

SHOP ID NO. ☐☐☐☐☐☐☐☐ DATE RECEIVED ___/___/___

OWNER IDENTIFICATION

Vehicle Owner: _____ Telephone: ( ) _____

Street Address: _____

City: _____ State: _____ Zip: _____

VEHICLE DATA

Manufacturer: American Motors _____ Chrysler Motors _____ Ford Motors _____ General Motors _____

Other: _____

Additional Model Information (If Any) _____

Make: _____ Model: _____

Year: 19_____ Mileage: _____ VEHICLE CODE: ☐☐☐☐☐☐☐☐☐☐

COMPONENT DATA

Component Classification: _____

Component Description: _____ ☐☐☐☐☐☐☐☐ CLASS ☐☐ S E

Component Mileage: _____ Date Removed _____

I.D. Marks: _____ ☐ O/R

☐ NO PART RECEIVED

☐ INFORMATION FROM SHOP

☐ INFORMATION FROM OWNER

FAILURE DESCRIPTION

FAULT CODES

CAUSE ☐☐

RESULT ☐☐

Exhibit 3.9 Failed Part Data Sheet

PRP NO. P _____

SHOP DATA

Part(s) Returned By: _____ _____ _____ _____

SHOP CODE NO. | CITY | STATE | ZIP

COMMENTS FROM SHOP

(ATTACH LETTERS)

PHOTOGRAPHS

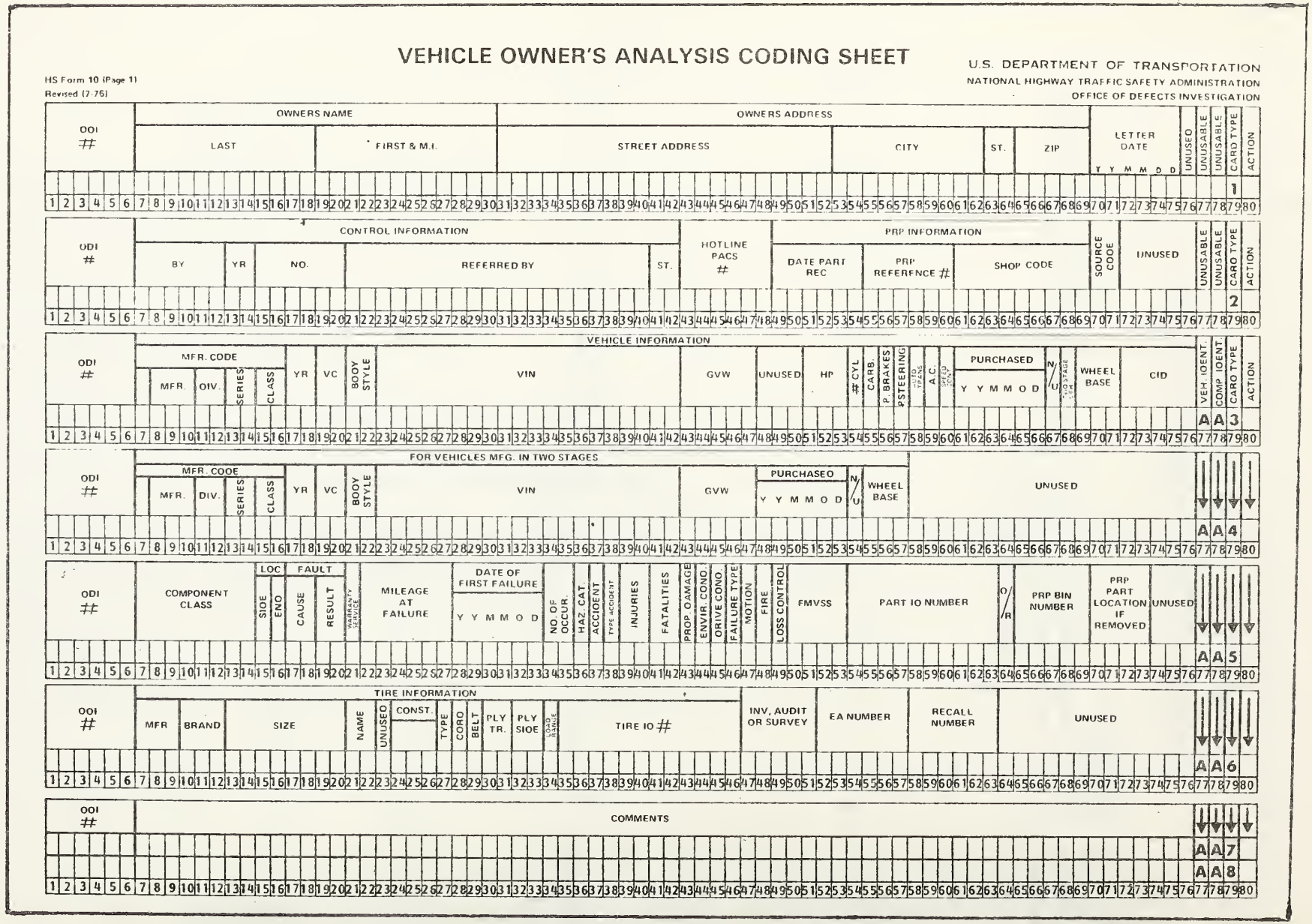


Exhibit 3.10 Vehicle Owner's Analysis Coding Sheet

Certificate of Participation

This is to certify that

_____

is actively participating to improve motor vehicle safety through cooperation in the

National Parts Return Program

for the years 1978 — 1979

U.S. DEPARTMENT OF TRANSPORTATION
National Highway Traffic Safety Administration

ISSUED BY: _____
PROGRAM MANAGER

CONTRACT NO. DOT-HS-6-01433

Exhibit 3.11 Certificate of Participation

The first step in the parts and information processing operation is the log-in process. This routine is conducted the day the part or information input is received at KSI. Information inputs are treated in the same way as parts in this log-in process.

The Log-in Sheet is used for this purpose. The following information is recorded:

1. The date the part (or information report) is received.

2. The shop ID number of the contributing member is then recorded.

   Each shop has a unique ID number consisting of its zip code and a sequential number for each state. When a part is received, the ID number is obtained from the back of the failed part tag. When an information report form is received, the ID number is obtained from the front of the card. When letters or telephone contacts are made, the ID number must be looked up in the Shop ID File and noted on the telephone contact sheet.

3. Utilizing the shop ID number, the shop name, managers name and address are located in the Shop ID File.

4. Again, utilizing the Shop ID File, the status of the shop (aa- already active; 1st A 79 - First time active contract year 1979; 1st A EVER - First time active ever) is determined.

   The shop status is determined from a two digit code which indicates the fiscal year the shop was last active. If the area is blank, the shop has never been active before and, hence, it is considered first active ever (1st A EVER). If CY79 is indicated, the shop is considered already active (AA). If a year other than CY79 is indicated, the code is updated to the current year and the shop is considered newly active in CY79 (1st A 79).

5. If the status of the shop is 1st A 79 or 1st A EVER, a check is placed in the column NEEDS CERT, indicating that the shop should receive a Certificate of Participation.

6. The input type (part, information card, telephone contact, letter) is then noted.

7. If a shop submits a part with a PRP mailbag, the column "needs bag" is checked.

8. Finally, vehicle information (model year, make, model) and component information are recorded. If more than one part is sent in a single bag, each vehicle and component is listed in the same block of the log-in sheet.

Next, the input itself is dated and transported to the appropriate area for coding and analysis. Each mailbag with parts is labeled with the date it was received. Information inputs (information cards, telephone contact sheets, etc.) are marked with the date received in the upper right hand corner. Information inputs remain in-house to be coded. Bags of parts are moved to a storage/analysis room and PRP record numbers are assigned. KSI's parts storage room is conveniently located in the adjacent office building in Arlington, Virginia. This allows quick retrieval of parts as needed by the ODI. The numbering scheme is set up not only to ensure that records in the ODI/DIS can be identified with the PRP as the source, but also that "Information Only" records are separated into two groups. These groups represent information obtained from either a written document (information card, letter, etc.) or a telephone contact.

PRP record numbers are six-character numbers beginning with P (as opposed to other characters, i.e., H or O for Hotlines or Owner Letters) so that they may be differentiated from other records in the ODI/DIS. The second character indicates the type of PRP record. The specific values of the second character position are as follows:

- 0 indicates that an actual component has been received (If the contributor is unknown, the shop ID number field will be zero filled).
- 8 indicates the record is an "Information Only" input received from a participating shop.
- 9 indicates the record is an "Information Only" input received from a participating shop through an initial telephone contact.

Parts that relate to the same failure are assigned the same PRP record number. Parts removed from the same vehicle at the same time that are not related to a single failure occurrence are assigned different record numbers. For example, if a frozen front disc brake caliper and a corresponding worn brake pad set were removed from a vehicle at the same time a leaking rear brake line was removed, they would be coded as follows:

- The frozen front disc brake caliper would be assigned a PRP record number.
- The corresponding pad set would be coded as a subsequent part using the same PRP record number.
- The leaking rear brake line, which does not have any obvious correlation to the frozen front caliper, would be assigned a different PRP number.
- The PRP numbers are recorded on the failed part component ID tag and the failed data sheet. Bin numbers are assigned randomly on a "space available" basis, except that parts with the same PRP number are stored in the same bin.

After the component has been assigned a PRP number, a failed data sheet is completed. Information report forms and telephone contacts are also recorded on failed data sheets. The failed data sheet is basically self-explanatory. A coding manual is necessary to complete the vehicle code maintaining information, except for failure description, is transcribed from the failed part ID tag, from the part itself, from the information report form or from the telephone contact sheet. The failure description area is used to record observations made by KSI analysts.

The failed data sheets are then returned to the KSI office for review prior to transcription to determine if a follow-up contact is necessary or desirable. Parts that meet one or more of the following requirements are subject to a follow-up call to the contributing shop to obtain missing or additional information:

- part was removed from a new or one-year-old model vehicle (in this case, 1978 or 1979)

- part may be related to a collision occurrence, or an accident or fire is indicated
- personal injury is indicated
- part is of particular interest for a newsletter article
- the part is of particular interest to the ODI
- significant information is missing and there is an indication that the data may still be available.

Once this supplementary data has been obtained and recorded on a telephone contact sheet, this information and information from the failed data sheet is transcribed to a Vehicle Owner Letter Coding Sheet (HS-10 Form). A coding manual and the PRP coding instructions are utilized here. The HS-10 Forms are submitted to NHTSA by KSI on a monthly basis.

3.3.2 Failure Analysis

Once a part has been logged-in, it is transmitted to the parts storage room where it undergoes failure analysis by a trained mechanic. Each part is carefully reviewed to determine, where possible, the failure mode and to verify the part type and the shop's failure description.

A failed Part Data Sheet is then prepared by our inspecting mechanic. This sheet requires the assignment of Component Classification, Fault, and Hazard Codes. In addition, it requires that the mechanic note the failure description in narrative and provide a conclusion and recommendation for further analysis to the NHTSA. The completed Failed Part Data Sheet will be used by the data transcriber to complete the applicable sections of the HS-10 Form, including relevant comments. Both forms are then forwarded to the NHTSA.

3.3.3 Manual Files

To insure a feasible data audit trail if the necessity should arise, the following documents are maintained in filing cabinets located in the KSI office.

- Completed copies of daily log-in sheets.
- Completed copies of HS-10 Forms and Failed Part Data Sheets.
- A copy of all positive and negative shop questionnaires.
- A master file of assigned shop identification numbers along with address, principal point of contact and telephone number.
- A copy of all previously released PRP newsletters.
- A master list of accountability for all mailbags and their distribution.
- Tabulations of monthly and cumulative parts lists.
- All progress reports delivered to the NHTSS and all previous Final Reports.

3.3.4 Automated Filing Systems

There are two data files used by KSI to fulfill the data processing requirements of the PRP. One is the automated Shop ID File. The Shop ID File is stored on a disk pack (direct access storage device) of KSI's in-house mini-computer PDP 11-34. The File consists of certain major data elements, which are: shop name, address and zip code, point of contact, usually the manager or owner; unique shop ID number; telephone number; the date of enrollment into the PRP; the date the shop was last active; identifying number for mailbags currently in the shop's possession. A code for the shop type was added to the file during CY1979.

Several output reports have been designed to operate off of the data stored in the Shop ID File. These reports include a listing of participants, with all recorded data sorted alphabetically by state and then numberically by shop ID number for either inactive shops, active participants, or both; a mailing label format including shop, contact name, and address only; and selections of shops by zip code. This file is also used to produce a "Totals by Region" report detailing the number of PRP members and active shops as well as the level of participation for each region.

The reports produced from the Shop ID File are used to monitor and document certain items such as mailbag inventory, shop participation and certificate recipients, and to maintain a current mailing list at the NHTSA for distribution of the monthly newsletter. Output reports (shop list by state and Totals by Region) are produced monthly; mailing labels are produced as required for distribution of the Defects Investigatory Cases Reports, etc.

The individual shop number is associated with the specific PRP region where the shop is located. These ten PRP regions correspond to the ten zip code regions and are identified by the first character of the zip code. The sole exception is in the state of New Jersey, which is part of PRP Region 1 although its zip code regions is O. In addition, the state and local geographic area of the shops are identified through a unique shop ID number. This number consists of eight characters, the first five being the zip code, and the last three, a numeric sequence number for the particular state. The three sequential numbers identify the unique record of a shop within its state and distinguish it from other shops located in the same city. A log is maintained identifying the highest sequential number that has been assigned for each state.

Each new shop enrolled during this contract year was assigned an identification number in the same manner as previously described, but with the addition of one character to precede the ID number. This character is either a 0 (zero), D, P, or F to identify the shop as an independent repair shop, new car dealership, parts supplier, or high mileage fleet, respectively. The system of nine characters not only identifies the types of shops enrolled but also distinguishes previously enrolled independent repair shops from those enrolled this year.

PRP mailbags used to return failed parts to the PRP are assigned unique sequential numbers. The mailbag number is entered on the shop's record and remains there until the mailbag is returned or the shop is deleted.

When a mailbag is returned and sent to another shop, the number is removed from the original record and entered on the record for the recipient shop. A log is maintained identifying the highest sequential number than has been assigned.

As parts and information are received, and as enrollment and discontinuances take place, modifications to the Shop ID File become necessary. These modifications include changes of bag numbers, status (active/inactive, etc.), and shop additions and deletions. Each of these update requirements is accomplished quite easily on-line, utilizing a DATATRIEVE update/retrieval software package and our in-house CRT. This eliminates the need for time-consuming coding/key-punching activities and provides a greater degree of management control.

After the updates are completed, a PRP shop list sorted in order alphabetically by state and shop ID number is produced from the file. The listing for each shop includes the owner's or manager's name and title, the shop name and identification number, and the address (street, city, state, area code, zip code, and phone number). Active shops can be identified on the computerized printout by an "A" on the third line after the telephone number. The latest year of participation, such as "79" follows. The current mailbag inventory is listed by bag number after the shop ID number. The shop list is used to identify incoming mailbags, to show shop activity status, to obtain shop addresses, and to determine subjects for follow-up campaigns.

The new shop list is verified against the shop list from the previous month. If found acceptable, a "Totals by Region" report is produced. The "Totals by Region" report is used to monitor the number of enrolled and active shops for each region and overall. The report also shows the regional and national levels of participation.

A second data processing tool utilized in the PRP data management operations is the ODI Data Information Systems (DIS) Vehicle Owner Letter File. All PRP inputs are entered into this file through the utilization of the

Vehicle Owner Analysis Coding Sheet (HS-10 Form). KSI has ready-only access to the ODI-DIS Letter File.

3.3.5 Monthly Reports

Current project status is recorded in a letter-type monthly Progress Report. The report is deliverable by the tenth of the month following the reporting period and is retained by the Office of Defects Investigation and the Office of Contracts and Procurement within the NHTSA. This progress report includes the following topics: accomplishments made during the reporting period; what is planned for accomplishment during the next reporting period; items of information that are of timely interest to the NHTSA; problems or delays in the operations of the PRP; and specific action that the NHTSA is requested to undertake in order to alleviate a problem.

The original Vehicle Owner's Analysis Coding Sheets (HS-10 Form) and the Failed Part Data Sheets are concurrently submitted to the NHTSA with the progress report. These forms reflect the data on the parts and information received during the month.

A table which summarized the information in these sheets is constructed and also submitted along with the progress report. The table includes the PRP number; component classification and name; failure description; corresponding vehicle make, model, model year, and mileage at failure; and the contributing shops' ID number. This monthly summary of input information is manually produced; it had been received as an automated report until the middle of this contract year.

A newsletter draft is designed, prepared in draft form and delivered to the NHTSA in the beginning of the month following the reporting period. Updates to the newsletter mailing list including new additions, deletions, and changes to name or address are also delivered to the NHTSA. These updates are delivered from the monthly transaction sheets produced when the automated PRP Shop ID File is updated.

3.4 PRP NEWS

The PRP News is distributed on a monthly basis to members of the PRP. The main objective of the PRP News is to maximize both the quantity and quality of safety-related defective parts submitted by program members. This end is achieved through efficient newsletter production, successful motivational techniques, effective educational methods, and focusing on newer model year vehicles. This publication is the PRP's principal means of communication with PRP shops and is designed to stimulate their participation as well as to keep them informed. KSI has been successful in maintaining an "information feed-back loop" using the newsletter by publishing information, comments and so forth, passed on by participants.

3.4.1 Newsletter Production

KSI follows a rigid monthly schedule for newsletter production. The process begins as ideas for news articles and photographs on significant parts and information inputs received, current NHTSA activities and current program status are construed. A staff meeting is held to review the potential articles and photographs and their placement within the newsletter layout. Those articles and pictures which are chosen, and their relative position in the layout are then relayed to the NHTSA for approval. Additions or modifications are often suggested at this point. Once initial approval has been obtained, articles are then written, edited and rewritten.

Articles are then typed on a standard type-conversion sheet designed by KSI which determines, based upon 12 pt. elite type, the amount of space each article will require when typeset as final copy at the NHTSA.

Once the initial typing is completed, the newsletter layout is developed by KSI. An attempt is made to include a picture or a graphic display on each page and integrated layouts are used wherever possible. The final draft is delivered to the NHTSA. Shortly thereafter, the layout and article contents are finalized.

All articles that appear in the PRP News are documented with source material. In the case of articles involving parts or information received, all contributors receive a telephone call to confirm the details of their submittal. At that time, they are informed that an article will appear in the newsletter using their name as a source.

There have been several significant modifications to the appearance of the PRP News during the past years. During the past year, CY1979, a "forum" page was introduced for shorter articles, member comments and items of interest. New typefaces have also been implemented to facilitate easier reading.

During CY1977, the format was reduced to four pages rather than the previous six. The newsletter layout was changed from two columns to three columns to allow for more interesting variations and headline use. Short articles of interest were also added during this period.

As an aid in the development of each newsletter, a series of matrices that depict previously published newsletter articles is prepared. Each matrix identifies a specific automotive component system, e.g. brakes, steering, etc., and then identifies the specific article published on that system by vehicle model year, sub-assembly and manufacturer. Finally, the entry on the matrix is recorded by date of application. A cumulative matrix for inputs from CY79 is included as Volume III.

3.4.2 Motivational Effect

KSI has always believed that the program's single most important motivational tool is the PRP News. The PRP News is used to inspire members to contribute to the PRP as many failed parts as possible. It is evident that when a PRP News article is inserted in an attempt to solicit information on a specific automotive component, the input count for that component system shows a significant increase.

Articles on failed parts are intended to bring more parts into the program, but the articles must also stress that these parts are needed by the NHTSA and that the shop is making a valuable contribution. Attribution to the contributing shop is critical, since non-contributing members can see that other shops are providing valuable information. This reinforces positive participatory attitudes on the part of the shops, while showing that submitting parts does not require much additional work.

The actual receipt of the newsletter by PRP members is a stimulus for sending in parts and information to the PRP. The greatest number of monthly telephone calls received from program members occur on the day the PRP News is received.

By using the PRP News as the motivational tool in the program, the number of inputs received from members is therefore heightened.

3.4.3 Knowledge Transfer

The PRP News is also used an an educational tool by improving the knowledge of members in these areas: PRP objectives and operations, what a safety-related defect is, what parts are needed for the program, and what the PRP accomplished for the NHTSA and for highway safety. By knowing what the program objectives are and what a safety-related defect is, a shop is more likely to make a valuable contribution to the PRP. By knowing what role they play in highway safety, members are apt to take a more active interest in the program. The newsletter is developed with these themes in mind.

A three part article entitled "What Ever Happened to the Part I Returned?" appeared in the PRP News this past year. The objective of the article was to inform members about what happens to failed parts submitted to the PRP focusing on parts and information processing, the engineering analysis/defect investigation process and the recall campaign. Members were made aware of the part they play in this process.

An article describing the present Federal Motor Vehicle Safety Standards was introduced this past year in the PRP News. It also serves as a form of knowledge transfer between the NHTSA and PRP members. Since the aim of the PRP is to promote highway safety, members should be aware of the safety standards that exist.

Program members are also kept up-to-date on current NHTSA and DOT activities through the PRP News. Publishing information on investigations and research results is necessary so that the reader can gain better knowledge of how NHTSA carries out its responsibilities as mandated by Congress.

All of the above means of educating shops results in the improvement of the quality of inputs received in the PRP.

3.4.4 Attention Focus

The PRP News has been effective in obtaining more parts and information on newer model year vehicles. By featuring articles on new model vehicles and emphasizing the need for more information on such vehicles, the newsletter is used to obtain failure information for vehicles one to two years old and also current model year vehicles.

3.5 ADMINISTRATOR'S AWARD

Annually, those shops that significantly contributed to the success of the PRP either in a quantitive or qualitative fashion are singled out for special recognition. In return for their support and assistance in furthering highway safety, these shops receive a framed Certificate of Appreciation. The award is personally signed by the NHTSA Administrator.

During the past contract year, the following shops received the Administrator's Award for their contributions to the PRP during CY1978:

Harry's Auto Service, Great Barrington, Massachusetts
Auto Brake Corporation, Norfolk, Virginia
Ise Automobile Service, North Hollywood, California

Kolesnik's Service Station, Rochester, New York
Las Vegas Wheel Alignment and Brake Service, Las Vegas, Nevada
L.A.D. Auto Electric, Spokane, Washington
Foreign Auto Service Center, Minneapolis, Minnesota
Big Brake Safety Center, Gulfport, Mississippi
Woody's Garage, Montoursville, Pennsylvania
Day-Nite Auto Station, Kaukauna, Wisconsin
A. Ruth's Garage, Colonia, New York
Automotive City Service Center, San Francisco, California
Bob Chester's Auto Service, Arlington, Texas
Bud Jones Service, Delmar, New York
Clemens Auto Repair, Racine, Wisconsin

Section 4

PROGRAM RESULTS

4.1 OVERVIEW

This section presents and analyses data submitted by the PRP membership during the past contract year, 1979, as well as the previous years, CY1976-CY1978. Results are discussed in terms of three related parameters measuring program effectiveness: 1) quantity of part or information inputs; 2) percentage of enrollees that were "active" or activity level [1]; and 3) number of inputs per active shop ratio or activity rate. During the last three years, CY 77 - CY 79, contributions consisted of actual-part inputs and information inputs (letters or telephone calls). During contract year 1976, only actual parts were collected.

The review initially centers on the analysis of contributions received from the total membership. First, we will analyze the total number of inputs received across regions. Next, the inputs will be described in terms of component classifications and model years.

The discussion will then focus on regional activity levels and activity rates of independent repair shops. Activity differences between various types of shops will also be noted. The activity of the Expansion Study membership is described in Volume II.

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[1] An establishment was categorized as "active" if it made at least one contribution, either an actual part or information input, during the contract year.

Finally, PRP inputs supportive of NHTSA investigations during the past year will be reviewed.

Before proceeding, a note must be made about the statistics used in this section. Analyses involving simple descriptive tabulations are fully discussed in the text. However, analyses involving inferential statistics are only referred to in the text, but presented in detail in the appendix to this volume (Notes on Statistical Analysis) for those readers who are concerned with statistical theory and the relevant calculations.

4.2 PROGRAM CONTRIBUTIONS: REGIONAL DIFFERENCES

During the past contract year the PRP received a total of 931 inputs. In previous years, all inputs totalled 942 (CY 76), 1408 (CY 77), and 852 (CY 78).

4.2.1 Part Inputs

Altogether, participants contributed 942 parts in CY 76, 1274 parts in CY 77, 759 parts in CY 78, and 645 parts in CY 79. The breakdown of total parts returned by regions for each year is presented in Table 4.1.

With regard to input patterns across years, a general trend that is apparent is the steady decline of part contributions since CY 77 for all regions. However, the declinations have ceased since CY 78 for Regions 1, 3, and 9. Unfortunately, due to a lack of detailed information about most program members, it is difficult to even speculate on the annual fluctuations of regional inputs. In some cases, though, we have been able to ascertain specific information through telephone conversations or correspondence with members concerning their activities. For example, Mr. Harry Billings of Sheffield Auto Electric (formerly Harry's Auto Service) reported that he was hospitalized for much of the past year. In this case, a dramatic effect occurred. Mr. Billings, one of our major contributors, sent in 73 and 93 inputs during CY 77 and CY 78, respectively. In the past year, however, he was able to contribute "only" 29 inputs. Consequently, his area, Region 0, showed a substantial decrease

Contract Year		Region 0	1	2	3	4	5	6	7	8	9	Yearly Total*
	Parts	60	98	82	58	69	102	181	22	57	189	918
1976	Monthly Avg.	5.0	8.2	6.8	4.8	5.8	8.5	15.1	1.8	4.8	15.8	76.5
	Yearly Pct.	6.5	10.7	8.9	6.3	7.5	11.1	19.7	2.4	6.2	20.6	100%
	Parts	145	201	93	45	66	179	134	36	80	296	1275
1977	Monthly Avg.	12.1	16.8	7.8	3.8	5.5	14.9	11.1	3.0	6.7	24.7	106.3
	Yearly Pct.	11.4	15.8	7.3	3.5	5.2	14.0	10.5	2.8	6.3	23.2	100%
	Parts	139	85	76	43	38	115	55	24	62	120	757
1978	Monthly Avg.	11.6	7.1	6.3	3.6	3.2	9.6	4.6	2.0	5.2	10.0	63.1
	Yearly Pct.	18.4	11.2	10.0	5.7	5.0	15.2	7.3	3.2	8.2	15.9	100%
	Parts	67	112	71	44	20	73	48	11	56	126	628
1979	Monthly Avg.	5.6	9.3	5.9	3.7	1.7	6.1	4.0	0.9	4.7	10.5	52.3
	Yearly Pct.	10.7	17.8	11.3	7.0	3.2	11.6	7.6	1.8	8.9	20.1	100%
4/Yr. Totals	Parts	411	496	322	190	193	469	418	93	255	731	3578
	Regional Pct.	11.5	13.9	9.0	5.3	5.4	13.1	11.7	2.6	7.1	20.4	100%

*Yearly-Total figures do not include anonymous contributions or inputs from non-members (e.g., private automobile owners).

Part Inputs By Region: CY1976 - CY1979

Table 4.1

in part returns (72) between CY 78 and CY 79.

Regarding the general trend of part return declination over the years, there is one operational factor that may be explanatory. Since CY 77, the PRP has included information reports in its data collection process. It is reasonable to believe that an active member who is given an option of submitting an information report rather than an actual part would be more likely to contribute information, due to its relative ease of transferance, especially by telephone. The general data pattern, across all regions, seems to support this possible explanation; the number of part returns has decreased between CY 78 and CY 79 while the quantity of information reports has increased markedly (see Table 4.3). However, it must be pointed out that the above pattern does not hold up within many regions, especially when using the yearly percentage figures. For example, between CY 78 and Cy 79, Regions 0, 1, 4, 5, 6 and 8 have shown an increase or a decrease in both the yearly percentages of part and information inputs. Consequently, the various annual trends remain unexplained.

Another type of trend that draws interest concerns regional differences in contributions within years. Table 4.1 indicates that regions do differ markedly with regard to part returns. One area (Region 7) contributed as few as 11 parts in CY 1979 while another area (Region 9) was responsible for 126 part returns. Similar variability has occurred in previous years. Table 4.2 presents hierarchical orderings of regional part inputs to facilitate comparisons. To determine whether these fluctuations could be explained by random chance factors or are variable enough to be statistically significant, analysis of variance (ANOVA) tests were performed on each contract year's set of data. Summaries of the calculations are shown in Notes 1 thru 4 (Appendix). Results indicate that the regional part-return differences for all four contract years are not very likely to be due to chance. Another explanation for regional part-return differences is, of course, the related pattern of enrollment differences (see Table 4.8 for figures on repair shop enrollments). During the past contract year, there was a strong correlation between part inputs and enrollments (r=.7). Since the correlation explains only half the variance (coefficient of determination =

CY 76	CY 77	CY 78	CY 79
R9 = 15.8*	R9 = 24.7	R0 = 11.6	R9 = 10.5
R6 = 15.1	R1 = 16.8	R9 = 10.0	R1 = 9.3
R5 = 8.5	R5 = 14.9	R5 = 9.6	R5 = 6.1
R1 = 8.2	R0 = 12.1	R1 = 7.1	R2 = 5.9
R2 = 6.8	R6 = 11.1	R2 = 6.3	R0 = 5.6
R4 = 5.8	R2 = 7.8	R8 = 5.2	R8 = 4.7
R0 = 5.0	R8 = 6.7	R6 = 4.6	R6 = 4.0
R3 = 4.8	R4 = 5.5	R3 = 3.6	R3 = 3.7
R8 = 4.8	R3 = 3.8	R4 = 3.2	R4 = 1.7
R7 = 1.8	R7 = 3.0	R7 = 2.0	R7 = 0.9

* Figures are mean monthly number of parts returned for each region

Hierarchical Ordering of Regional Part Inputs:
CY1976 - CY1979

Table 4.2

r^2 = .5), there are other factors involved too. Unfortunately, exploring other factors is beyond the scope of current available information.

4.2.2 Information Inputs

Overall, participants contributed 134 information inputs in CY 77, 93 information inputs in CY 78, and 286 in CY 79. The breakdown of total information inputs received from regions for each year (except CY 76) is presented in Table 4.3.

The first noticeable trend is the increase in information reports over the years. The decreases in part returns have been more than compensated for by the increases in information inputs. It's a positive sign that more information-only inputs are being received, since it may mean more information on recent-model vehicles under warranty (defective parts from new vehicles are usually returned to the manufacturer). However, a question arises as to whether there is a trade-off between the two types of inputs. As mentioned in the previous sub-section, there does not seem to be a trade-off at the regional level of data reduction.

Although there are regional differences in information reports within years similar to the actual-part data, no ANOVA tests were performed due to overall low quantitative levels.

4.3 COMPONENT CLASSIFICATIONS

In addition to the regional differentiation of data, total inputs have also been broken down by component categories and model years (next sub-section). Overall, across all inputs during the past three contract years, brakes had the highest percentage of inputs (25.9%). The next most common categories are engine components (14.5%) and fuel system data (14.3%).

Contract Year		Region 0	1	2	3	4	5	6	7	8	9	Yearly Total*
1976	Information Monthly Avg. Yearly Pct.	PRP data did not include information inputs in 1976										
1977	Information	3	18	15	6	2	17	21	4	11	27	124
	Monthly Avg.	0.3	1.5	1.3	0.5	0.2	1.4	1.8	0.3	0.9	2.3	10.3
	Yearly Pct.	2.4	14.5	12.1	4.8	1.6	13.7	16.9	3.2	8.9	21.8	100%
1978	Information	9	11	7	9	6	10	14	6	6	13	91
	Monthly Avg.	0.8	0.9	0.6	0.8	0.5	0.8	1.2	0.5	0.5	1.1	7.6
	Yearly Pct.	9.9	12.1	7.7	9.9	6.6	11.0	15.4	6.6	6.6	14.3	100%
1979	Information	17	59	17	23	3	19	65	23	26	19	271
	Monthly Avg.	1.4	4.9	1.4	1.9	0.3	1.6	5.4	1.9	2.2	1.6	22.6
	Yearly Pct.	6.3	21.8	6.3	8.5	1.1	7.0	24.0	8.5	9.6	7.0	100%
4/Yr. Totals	Information	29	88	39	38	11	46	100	33	43	59	486
	Regional Pct.	6.0	18.1	8.0	7.8	2.3	9.5	20.6	6.8	8.8	12.1	100%

(ear-Total figures do not include anonymous contributions or inputs from non-members .g. private automobile owners).

Information Inputs By Region: CY1977 - CY1979

Table 4.3

4.3.1 Part Inputs

Table 4.4 presents the breakdown of parts received over the contract years 1977, 1978, and 1979. During the past year, the most common parts received were related to the: brakes (26.3%), fuel system (18.1%), engine (13.0%), electrical system (10.2%), suspension system (9.7%), lights & horn (9.2%) and steering system (8.5%). Looking at the trends across years, it seems that fuel and electrical system-related parts have been received more frequently (on a percentage basis) while the percentages of engine and steering components have been on the decline.

4.3.2 Information Inputs

Information-only data on the component categories have been differentiated in Table 4.5. These types of data have been most abundant last year in categories related to the fuel (19.6%), brake (15.4%), and suspension systems (13.7%). The most notable temporal patterns here are the percentage increases between CY 77 and CY 79 in information related to the fuel system and heater/defroster/air conditioner and the decrease in suspension information.

4.4 MODEL YEAR

NHTSA has considered it important to obtain more inputs on defective components from newer vehicles. In the past year, much of the data has centered on models 1-3 years old. Only 6 total inputs concerned vehicles less than one year of age.

4.4.1 Part Inputs

Parts are differentiated by vehicle year in Table 4.6. Parts received in CY 79 were most representative of vehicles that were 2, 3, and 6 years old (14.0, 14.8 and 14.8%, respectively). Vehicles that were one-year old accounted for 6.5% of the actual-part data. Perhaps due to PRP campaign publicity, parts from vehicles less than 3 years old have been steadily increasing

	CY1977		CY1978		CY1979	
	Parts	Pct.	Parts	Pct.	Parts	Pct.
Steering	164	12.9	93	12.2	52	8.5
Suspension	137	10.8	62	8.2	59	9.7
Brakes	359	28.2	216	28.5	160	26.3
Engine	233	18.3	109	14.4	79	13.0
Fuel System	146	11.5	107	14.1	110	18.1
Power Train	54	4.3	34	4.5	23	3.8
Electrical System	59	4.6	54	7.1	62	10.2
Lights & Horn	86	6.8	46	6.1	56	9.2
Visual Systems	5	0.4	5	0.7	2	0.3
Heater/Defroster/AC	24	1.9	21	2.8	3	0.5
Interior Systems	2	0.2	6	0.8	2	0.3
Structure	2	0.2	4	0.5	0	0.0
TOTAL *	1271	100%	757	100%	608	100%

*This table does not include inputs which could not be classified into the above categories.

Part Inputs By Component Classification:
CY1977 - CY1979

Table 4.4

	CY1977		CY1978		CY1979	
	Info.	Pct.	Info.	Pct.	Info.	Pct.
Steering	15	11.2	8	8.7	31	10.1
Suspension	51	38.1	10	10.9	42	13.7
Brakes	18	13.4	19	20.7	47	15.4
Engine	11	8.2	12	12.9	14	4.6
Fuel System	9	6.7	21	22.8	60	19.6
Power Train	12	9.0	10	10.9	30	9.8
Electrical System	7	5.2	1	1.1	30	9.8
Lights & Horn	0	0.0	0	0.0	3	1.0
Visual Systems	1	0.7	0	0.0	0	0.0
Heater/Defroster/AC	1	0.7	0	0.0	29	9.5
Interior Systems	0	0.0	0	0.0	1	0.3
Structure	9	6.7	11	12.0	19	6.2
TOTAL *	134	100%	92	100%	306	100%

* This table does not include inputs which could not be classified into the above categories.

Information Inputs By Component Classification:
CY1977 - CY1979

Table 4.5

Vehicle Age	CY1977			CY1978			CY1979		
	Year	Parts	Pct.	Year	Parts	Pct.	Year	Parts	Pct.
Current-New	77	4	0.3	78	0	0.0	79	2	0.4
1 Year Old	76	41	3.6	77	52	7.2	78	35	6.5
2 Years Old	75	95	8.3	76	69	9.5	77	76	14.0
3 Years Old	74	140	12.2	75	82	11.3	76	80	14.8
4 Years Old	73	200	17.4	74	121	16.7	75	62	11.5
5 Years Old	72	151	13.2	73	131	18.1	74	58	10.7
6 Years Old	71	139	12.1	72	73	10.1	73	80	14.8
7 Years Old	70	112	9.8	71	44	6.1	72	29	5.4
8 Years Old	69	80	7.0	70	59	8.2	71	26	4.8
9 Years Old	68	65	5.7	69	38	5.3	70	37	6.8
10 Years Old	67	57	5.0	68	16	2.2	69	26	4.8
11 Years Old	66	42	3.7	67	13	1.8	68	10	1.9
12 Years or more	-	21	1.8	-	25	3.5	-	20	3.7
TOTAL *	-	1147	100%	-	723	100%	-	541	100%

*This table does not include inputs from which vehicle age could not be determined.

Part Inputs By Model Year:
CY1977 - CY1979

Table 4.6

over the past three contract years.

4.4.2 Information Inputs

While few information-only inputs are also received from current model years, 30.1% of the information does concern vehicles only one year old, a difference of 23.6% relative to part inputs (see Table 4.7). This represents a substantial increase in one year old information inputs from two years ago. Thus, it seems that the introduction of information reports in CY 77 was effective in producing more recent model-year data.

Vehicle Age	CY1977			CY1978			CY1979		
	Year	Info.	Pct.	Year	Info.	Pct.	Year	Info.	Pct.
Current-New	77	0	0.0	78	7	9.0	79	4	1.5
1 Year Old	76	13	9.7	77	23	29.5	78	80	30.1
2 Years Old	75	23	17.2	76	16	20.5	77	51	19.2
3 Years Old	74	19	14.2	75	7	9.0	76	37	13.9
4 Years Old	73	15	11.2	74	7	9.0	75	28	10.5
5 Years Old	72	9	6.7	73	4	5.1	74	25	9.4
6 Years Old	71	4	3.0	72	4	5.1	73	12	4.5
7 Years Old	70	11	8.2	71	2	2.6	72	2	0.8
8 Years Old	69	1	0.7	70	6	7.7	71	12	4.5
9 Years Old	68	1	0.7	69	0	0	70	4	1.5
10 Years Old	67	1	0.7	68	0	0	69	2	0.8
11 Years Old	66	4	3.0	67	0	0	68	0	0.0
12 Years or more	-	33	24.6	-	2	2.6	-	9	3.4
TOTAL *	-	134	100%	-	78	100%	-	266	100%

*This table does not include inputs for which vehicle age could not be determined.

Information Inputs By Model Year:
CY1977 - CY1979

Table 4.7

4.5 REPAIR SHOP PARTICIPATION

As we begin focusing on our core membership, the independent repair shops, consideration will be given to the other major types of PRP performance data: activity levels and activity rates. These parameters will initially be used to analyze regional differences and then applied in the evaluation of the various types of shops.

4.5.1 Membership Activity Levels

The percentage of enrollees that contribute an actual part or information report during a contract year is labelled an "activity level". It is disappointing that most shops voluntarily enrolled in the Program do not submit even one part or piece of information during any given year (see Table 4.8). On the other hand, we can always depend on a few shops to contribute several dozen inputs every year. Exhibit 4.1 lists the repair shop members that have contributed during CY 79. Most active members contributed only one, two or three inputs all year. It is interesting to note that the top 19 shops accounted for half of the total shop inputs and the top 5 produced a quarter of all the contributions by themselves. Since it takes only a handful to make a significant difference, we would like to express our formal appreciation to the five most productive PRP members over the past three contract years (yearly average number of inputs contributed are in parentheses to the right):

Sheffield Auto Electric (formerly Harry's Auto Service) Sheffield, MA	(65.0)
Ise Automotive Service Hollywood, CA	(55.7)
Auto Brake Corporation Norfolk, VA	(51.0)
L.A.D. Auto Electric Spokane, WA	(33.3)
Kolesnik's Service Station Rochester, NY	(30.3)

Contract	Region	# of Shops Enrolled*	# of Active Repair Shops**	Pct. of Shop Members Active
1976	0	134	29	21.6
	1	224	45	20.1
	2	222	33	14.9
	3	170	25	14.7
	4	216	33	15.3
	5	153	33	21.6
	6	183	31	16.9
	7	150	20	13.3
	8	169	25	14.8
	9	230	61	26.5
	Total	1851	335	18.1
1977	0	149	22	14.8
	1	287	38	13.2
	2	210	19	9.0
	3	101	12	11.9
	4	188	18	9.6
	5	144	25	17.4
	6	162	20	12.3
	7	148	16	10.8
	8	217	23	10.6
	9	189	41	21.7
	Total	1795	234	13.0

* Due to the fluctuation of program enrollment month by month, the yearly figures for each region were estimated from previous monthly reports to represent an average level of enrollment during the contract year.

** An establishment is classified as "active" if it contributes at least one part or information input during the contract year.

Repair Shop Activity By Region: CY1976 - CY1979

Table 4.8

Contract	Region	# of Shops Enrolled	# of Active Repair Shops	Pct. of Shop Members Active
1978	0	142	17	12.0
	1	261	26	10.0
	2	202	16	7.9
	3	137	15	10.9
	4	118	12	10.2
	5	193	25	13.0
	6	199	20	10.1
	7	137	9	6.6
	8	245	19	7.8
	9	190	31	16.3
	Total	1824	190	10.4
1979	0	137	24	17.5
	1	244	38	15.6
	2	223	16	7.2
	3	150	17	11.3
	4	87	12	13.8
	5	191	23	12.0
	6	195	20	10.3
	7	143	11	7.7
	8	238	24	10.1
	9	205	22	10.7
	Total	1813	207	11.4

Exhibit 4.1

PARTS OR INFORMATION RECEIVED
FROM ACTIVE SHOPS - CY1979

NUMBER OF INPUTS	SHOP NAME	CITY & STATE
49	Ise Automotive Service	Hollywood, CA (b) *
46	Auto Brake Corporation	Norfolk, VA (b)
41	Tim's Import Sales and Service	Hutchinson, KS (b)
37	Wales Garage	Ft. Lauderdale, FL (b)
32	L.A.D. Auto Electric	Spokane, WA (b)
29	Sheffield Auto Electric	Sheffield, MA (b)
19	Day-Nite Auto Station	Kaukauna, WI (b)
18	Bothel's Garage	Cape Elizabeth, ME (b)
17	Kolesniks Service Station	Rochester, NY (b)
14	Automotive City Service Center	San Francisco, CA (b)
13	Gil's Safety Service	Ridgewood, NJ (a)
13	Wheel Alignment & Brake Service	Las Vegas, NV (c)
11	Feld Garage, Inc.	Kenosha, WI (b)
11	Fox Automotive	Tulsa, OK (a)
10	D&Z Atlantic	Cornwell Hts, PA (b)
10	Del Hatt Alignment & Auto Repair, Inc.	Poughkeepsie, NY (c)
9	M&B Automobile Repair	Phoenix, AZ (b)
9	McNaughton Motor Service	Minneapolis, MN (b)
9	Raymond's Auto Repair	Chicago, IL (b)
9	Taylor's Garage & Service Station	Akron, OH (c)
8	Brooklyn Center Shell	Brooklyn Center, MN (a)
8	German Auto Works	St. Louis, MO (a)
8	Joe's Repair Service	Nampa, ID (a)
8	John's Body Shop	Binghamton, NY (c)
8	S&D Tire Auto Center	Salt Lake City, UT (b)
8	Woody's Garage	Montoursville, PA (b)
7	B.W. Riley Alignment & Brake Service	Springfield, VA (b)
7	Brake-O-Mat	Evanston, IL (c)
7	Bud Jones Service	Delmar, NY (b)
7	Clemen's Auto Repair	Racine, WI (b)
7	Sunray Oil & Gas	Tampa, FL (c)
7	Wayne's Garage	Eugene, OR (b)
6	Duncan's Auto Repair	Phoenix, AZ (b)
6	Gil's Automotive Service	Sioux City, IA (b)
6	Lincoln Technical Institute	Union, NJ (c)
6	Robert's Auto Repair	Chicago, IL (b)

NUMBER OF INPUTS	SHOP NAME	CITY & STATE
6	Salyer's Garage	Decatur, GA (c)
6	Suburban Automotive	Lynnwood, WA (c)
5	Automatic Transmission Service	San Diego, CA (b)
5	Belmont's Garage	Langhorne, PA (c)
5	Bob's Service Station	Hammond, IN (b)
5	Doc's Auto Repair	Mesa, AZ (b)
5	Gordie's Auto Service	West Chester, PA (b)
5	Inselman Garage	Lincoln, NB (c)
5	W&S Service, Inc.	Wilmington, DE (c)
4	Abbott's Garage	S. Norwalk, CT (c)
4	Alameda Foreign Car Garage	Las Cruces, NM (a)
4	B&N Axle Service	Austin, TX (c)
4	Flair Auto	Chicago, IL (c)
4	Frank's Automotive Specialist	Montour Falls, NY (a)
4	Fuselier's Auto Service	Lake Charles, LA (c)
4	Hansen Automotive	Minneapolis, MN (b)
4	Hutt & Stiles	Skokie, IL (b)
4	Katon's Garage	Lead, SD (c)
4	Mr. Brake - So. State St.	Orem, UT (a)
4	Spain Equipment Company	Booneville, MS (a)
4	Swansen's Auto Repair	Chicago, IL (c)
3	Auto Hospital	Lincoln, NB (b)
3	Cornwall Bridge Texaco	Cornwall Bridge, CT (a)
3	Engebretsen's Auto	Green Bay, WI (a)
3	Henniker Automotive	Henniker, NH (b)
3	J&S Alignment Service	Colorado Springs, CO (a)
3	Samo Wheel & Brake	Santa Monica, CA (b)
3	Scotti's Auto Repair	King of Prussia, PA (c)
3	System Brake Service	Perth Amboy, NJ (c)
2	Artie's Service Station	La Grangeville, NY (c)
2	Auto Safety Service, Inc.	Ft. Lauderdale, FL (b)
2	Big Brake of Stockton	Stockton, CA (c)
2	Bob's Automotive	Dayton, OH (c)
2	Brown Road Exxon Service	Mesa, AZ (a)
2	C&S Brake Service	Fort Worth, TX (b)
2	Casey's Sports Car Service	Wichita, KS (c)
2	Cherrydale Motors, Inc.	Arlington, VA (c)
2	Dana Meyer Foreign Car Service	Albany, CA (b)
2	Duane's Tune-Up Clinic	Manteca, CA (b)
2	Dzamko's Amoco	Danbury, CT (a)
2	Foreign Car Specialists	Albuquerque, NM (a)
2	Ike's Automotive Maintenance	Montgomery, AL (b)

NUMBER OF INPUTS	SHOP NAME	CITY & GARAGE
2	Jack's Auto Repair Service	Chamblee, GA (a)
2	Jay's Auto Service	Lake Charles, LA (c)
2	John's Garage	Nampa, ID (b)
2	Lexington Brake	Lexington, KY (b)
2	Maddox Auto Service	Atlanta, GA (a)
2	Matthias Auto Service, Inc.	Norfolk, VA (c)
2	Maurice's Automotive	Hollywood, CA (b)
2	McMiller's Auto Repair Service	Duluth, MN (c)
2	Meade & Greenlee Garage	Salem, OR (b)
2	Mr. Brake - So. Highland Dr.	Salt Lake City, UT (a)
2	Musten Auto Service	Winston-Salem, NC (b)
2	Nodi's Auto Repair	Glastonburg, CT (a)
2	Paul's Garage, Inc.	Dayton, OH (b)
2	Prontano's Service	Worcester, MA (a)
2	Reed's American	Rockville, MD (b)
2	Richard's Auto Service	Los Angeles, CA (c)
2	Riverside Automotive Service	Boise, ID (b)
2	Rope Garage	Cibolo, TX (b)
2	Roxbury Garage	Roxbury, CT (a)
2	Sassaman * Burden Auto Service	Temple, PA (b)
2	Vanowen Brake & Wheel	North Hollywood, CA (b)
2	Vin's Motor Service	Brooklyn, NY (b)
2	Washington Garage	Bergenfield, NJ (a)
2	Winslow's Mobile Station	Gorham, ME (c)
1	A&F Alignment	Long Beach, CA (c)
1	A. Ruths Garage	Albany, NY (b)
1	Aable Auto Service	San Francisco, CA (a)
1	Arizona Brake & Clutch Supply	Phoenix, AZ (a)
1	Atwell Auto Repair	St. Louis, MO (b)
1	Blue Jay Standard	Green Bay, WI (c)
1	Bob's Auto Clinic	Sunnyside, WA (c)
1	Bobbit's Car Clinic	Colorado Springs, CO (c)
1	Bridgeport Garage	Bridgeport, PA (a)
1	Bridgeport Standard Service	Bridgeport, MI (a)
1	Burke Citgo Service Center	Burke, VA (c)
1	C&R Garage	Hartford, CT (b)
1	Cecil's 66 Service	Kansas City, MO (a)
1	Central City Garage	Harrisburg, PA (b)
1	Central Park Service	Kenosha, WI (c)
1	Chester's Body & Repair	Cleveland, OH (b)
1	Crane Auto Repair	Bricktown, NJ (b)
1	Curt's Auto Service	Boise, ID (a)

NUMBER OF INPUTS	SHOP NAME	CITY & GARAGE
1	D&N Auto Service	Phoenix, AZ (a)
1	Deutzville Garage	Trenton, NJ (b)
1	Eagle Transmission, Inc.	Elmira, NY (a)
1	Eddie's Garage	Nashville, TN (b)
1	Ehrlich Auto Repair & Supply	Albany, NY (a)
1	Father & Son Garage	Detroit, MI (a)
1	Ferino Brothers Exxon	Feasterville, PA (b)
1	Fisher's Service Brake	Muncie, IN (c)
1	Frank's Front End Service	Manchester, NH (c)
1	Gehrke & Young	Weiser, ID (c)
1	Gene Casey Arco Station	Lynn, MA (b)
1	Heatherdowns Automotive Service	Toledo, OH (c)
1	Hills Automotive Clinic, Inc.	Abilene, TX (c)
1	Jackson Excavating, Co.	Jackson, MO (a)
1	James Coulston, Inc.	Norristown, PA (a)
1	John's Union Service	Bainbridge Isl. WA (a)
1	Jordon Auto Service, Inc.	Colorado Springs, CO (c)
1	Joyce Motors	Arlington, VA (b)
1	Ken's Drive Shafts	Martinez, CA (c)
1	Ken's General Repair	Saginaw, MI (a)
1	King Co. Brake Service	Seattle, WA (b)
1	Larry Gaida's Service Station	Duluth, MN (c)
1	Marty's Auto Shop	St. Louis, MO (a)
1	Mayer Auto Service	Marysville, MA (c)
1	Midas Muffler	Pennsauken, NJ (b)
1	Mike's Service Center, Inc.	Winchester, VA (c)
1	N.Y. Auto Radiator & Body Shop	Albany, NY (b)
1	Pedley Garage	Owensboro, KY (c)
1	Pro-Tune	Port Arthur, TX (b)
1	Ralph Cannon Auto Service, Inc.	Atlanta, GA (b)
1	Ray's Auto Clinic	Orem, UT (c)
1	Red Ivey's Automotive Service	Atlanta, GA (b)
1	Richfield Wheel Alignment	Richfield, MN (b)
1	Rite-Way Garage	Harrisburg, PA (c)
1	Rudy's Auto Service	Lincoln, NB (a)
1	Russell's Auto Salon	Rochelle Park, NJ (a)
1	Schubert's Auto Supply	Poughkeepsie, NY (a)
1	Smith Auto Service, Inc.	Richmond, VA (c)
1	Staple's Chevron Station	Colorado Springs, CO (c)
1	Stop & Go Brake & Wheel Service	Portland, OR (b)
1	Strahl's Automotive	Canoga Park, CA (c)
1	Superior Wheel Alignment & Brake Service	Charlotte, NC (c)

NUMBER OF INPUTS	SHOP NAME	CITY & GARAGE
1	The Brake Shop, Inc.	East Norwalk, CT (c)
1	Tom's Southside Alignment & Repair	Arlington, TX (b)
1	Tommy's Automotive	San Angelo, TX (b)
1	Tuck's Service Center, Inc.	Hudson, MA (c)
1	Tyson's Auto Clinic	Vienna, VA (a)
1	West Erwin Auto Repair	Tyler, TX (b)
1	Wheel Works, Inc.	Marlow Hts, MD (a)
1	Yon Brother's Garage	Charleston, SC (b)
1	Youngwood Exxon	Youngwood, PA (a)

* (a) - First active ever in '79

(b) - Active in '79 and '78

(c) - Active in '79, inactive in '78, previously active

Table 4.8 lists for each region the number of shops enrolled, the number of active repair shops, and the percentage of shop members that were active (activity level) for each year. With reference to annual trends, the total activity level has declined from CY 76, reaching a low point in CY 78. This decrease is apparently a statistically significant one (see Note 5) and warrants consideration of a stronger incentive campaign to enhance membership feedback.

As in the input data, regions also differ in their activity levels. A hierarchical ordering of regional activity levels for each year is presented in Table 4.9. During the past year, activity levels were as low as 7.2% (Region 2) and as high as 17.5% (Region 0). Although there seems to be a great deal of variability, the regional differences were not great enough to be statistically significant according to the Chi Square test (Note 9). The variability in CY 78 is likewise not significant (Note 8). However, the differences in both CY 76 and CY 77 were significant (Notes 6 and 7).

Regarding trends in activity level across the years, there is one interesting note that must be made. This concerns the decline of Region 9's level of activity. After having the highest level for three years, this area dropped its activity to a level of 10.7% during the past year which was sixth in the hierarchy.

4.5.2 Activity Rates

An "activity rate" is the ratio between the number of inputs and the number of active establishments in a given region. For purposes of program evaluation, the activity level and activity rate are two very useful independent determinants of program effectiveness since each is conceptually related and empirically correlated ($r = .69$ and $.84$ in CY 79, respectively) with the single best measure of program performance, input quantity; yet the two are not correlated with each other ($r = .11$ in CY 79).

Table 4.10 presents data on the number of active repair shops, part inputs, and activity rates for each region and year. Regions are ordered hierarchically for each variable. Obviously, regions with the most inputs and

CY 76	CY 77	CY 78	CY 79
R9 = 26.5*	R9 = 21.7	R9 = 16.3	R0 = 17.5
R5 = 21.6	R5 = 17.4	R5 = 13.0	R1 = 15.6
R0 = 21.6	R0 = 14.8	R0 = 12.0	R4 = 13.8
R1 = 20.1	R1 = 13.2	R3 = 10.9	R5 = 12.0
R6 = 16.9	R6 = 12.3	R4 = 10.2	R3 = 11.3
R4 = 15.3	R3 = 11.9	R6 = 10.1	R9 = 10.7
R2 = 14.9	R7 = 10.8	R1 = 10.0	R6 = 10.3
R8 = 14.8	R8 = 10.6	R2 = 7.9	R8 = 10.1
R3 = 14.7	R4 = 9.6	R8 = 7.8	R7 = 7.7
R7 = 13.3	R2 = 9.0	R7 = 6.6	R2 = 7.2

* Figures are percentages of repair shops that were active for each region.

Hierarchical Ordering of Regional Repair Shop Activity:
CY1976 - CY1979

Table 4.9

CY 76			CY 77			CY 78			CY 79		
# of Active Repair Shops	Part Inputs	Part Inputs Per Active Shop Ratio	# of Active Repair Shops	Part Inputs	Part Inputs Per Active Shop Ratio	# of Active Repair Shops	Part Inputs	Part Inputs Per Active Shop Ratio	# of Active Repair Shops	Part Inputs	Part Inputs Per Active Shop Ratio
R9=61	R9=189	R6=5.8	R9=41	R9=296	R9=7.2	R9=31	R0=139	R0=8.2	R1=38	R9=126	R9=5.7
R1=45	R6=181	R9=3.1	R1=38	R1=201	R5=7.2	R1=26	R9=119	R2=4.7	R0=24	R1=109	R2=4.4
R5=33	R5=102	R5=3.1	R5=25	R5=179	R6=6.7	R5=25	R5=104	R5=4.2	R8=24	R2=70	R5=3.0
R4=33	R1=98	R2=2.5	R8=23	R0=145	R0=6.6	R6=20	R1=84	R9=3.8	R5=23	R5=69	R1=2.9
R2=33	R2=82	R3=2.3	R0=22	R6=134	R1=5.3	R8=19	R2=75	R8=3.3	R9=22	R0=63	R0=2.6
R6=31	R4=69	R8=2.3	R6=20	R2=93	R2=4.9	R0=17	R8=62	R1=3.2	R6=20	R8=55	R3=2.6
R0=29	R0=60	R1=2.2	R2=19	R8=80	R3=3.8	R2=16	R6=53	R3=2.8	R3=17	R6=47	R6=2.4
R8=25	R3=58	R4=2.1	R4=18	R4=66	R4=3.7	R3=15	R3=42	R4=2.8	R2=16	R3=44	R8=2.3
R3=25	R8=57	R0=2.1	R7=16	R3=45	R8=3.5	R4=12	R4=33	R6=2.7	R4=12	R4=20	R4=1.7
R7=20	R7=22	R7=1.1	R3=12	R7=36	R7=2.3	R7=9	R7=23	R7=2.6	R7=11	R7=11	R7=1.0

Hierarchical Ordering of Regional Ratios of
Part Inputs Per Active Repair Shop:
CY1976 - CY1979

Table 4.10

fewest active shops contain the highest number of productive shops. Except in CY 78 when Mr. Harry Billings contributed 93 inputs from Region 0, Region 9 has had the highest or second highest activity rate in the PRP. A major explanation lies in the fact that Region 9 contains two of the most productive members: Ise Automotive Service and L.A.D. Auto Electric.

Thus, an effective strategy for improving the Parts Return Program should focus on manipulating activity levels and activity rates. By stimulating non-active program enrollees to action and motivating the already-active members to continue contributing, we will be assured of gaining better results.

4.5.3 Shop Types

Breaking down the annual data into regions is one way of determining where the contributions to the Parts Return Program are coming from. Another way of analyzing the repair shop membership is to divide it into various "shop type" categories and see what the performance differences are. For this purpose, we classified the shops initially into five categories: (1) general repair shops (other than service stations), (2) special repair garages (i.e., brake, tire, electrical, transmission, alignment, or other specialized services), (3) service stations, (4) foreign repair garages, and (5) automobile repair schools. Since there were relatively few foreign car garages and repair schools, they were lumped into the fourth category together during data tabulations.

Table 4.11 presents annual data on the four shop-type categories for the following parameters: number of responses, number of active shops, number of shops enrolled, percentage of shop members active (activity level), and responses per active shop ratio (activity rate). In the first parameter, a "response" is defined as "a contact from a PRP member with at least one input involved". The contact could be a mailbag (regardless of the quantity of parts in the bag), letter or telephone call. The reason for using "responses" instead of "inputs" was that we were only able to tabulate data on shop types from our log-in sheets which, prior to CY 79, did not list the quantity of inputs received during

Contract Year	Shop Type	# of Responses	# of Active Shops	# of Shops Enrolled*	Pct. of Shop Mbrs. Active	Responses Per Active Shop Ratio
1977	General Repair Garage	553	138	1154	11.9	4.0
	Special Repair Garage	203	50	275	18.2	4.1
	Service Station	201	31	314	9.9	6.5
	Foreign Grgs. & Schools	45	15	63	23.8	3.0
	Total	1002	234	1806	12.9	4.3
1978	General Repair Garage	424	120	1145	10.5	3.5
	Special Repair Garage	112	45	259	17.4	2.5
	Service Station	109	18	323	5.6	6.1
	Foreign Grgs. & Schools	12	7	70	10.0	1.7
	Total	657	190	1797	10.6	3.5
1979	General Repair Garage	428	131	1177	11.1	3.3
	Special Repair Garage	137	36	246	14.6	3.8
	Service Station	105	27	318	8.5	3.9
	Foreign Grgs. & Schools	52	13	71	18.3	4.0
	Total	722	207	1812	11.4	3.5

* Since it was not possible to obtain enrollment information concerning the types of repair shops from monthly reports, the figures in this table were derived from the annual Shop ID Files which indicate the enrollment levels at the conclusion of a contract year.

Participatory Differences Between Four Categories of Repair Shops:

CY1977 - CY1979

Table 4.11

a contact. Thus, we had to analyze the input data only at the more general level of "responses".

The data in Table 4.11 indicate that most of the shops were classified as general repair garages (65% in CY 79). Less than 4% were in the category of foreign garages or schools. With regard to levels and rates of activity, two interesting trends were apparent. Service stations were consistent across the years in having the lowest activity level (e.g., 8.5% in CY 79), but they also have had the highest or second highest activity rate (6.5 in CY 77 and 3.9 in CY 79). Also, over the years, the different types of shops convergedsomewhat in their activity levels and rates. In CY 79, rates varied only between 3.3 and 4.0.

To investigate shop-type trends statistically, two sets of analyses were conducted. One set focused on the differences in a particular type of shop's activity level across the contract years while the other set focused on the activity-level differences between shop types in a particular year. Chi-Square tests were used in these analyses. Due to the small memberships of foreign garages and repair schools, they were excluded from the tests. According to the first set of analyses (Notes 10-12), each of the three categories of shops tested did not indicate significant differences across the contract years. According to the second set of tests, the shop types differed from each other significantly in CY 77 and CY 78, but not in CY 79 (see Notes 13-15). Therefore, in those two years, it seems evident that a higher percentage of specialty garages participated in the PRP actively while, on the other hand, relatively few service stations were active. Unfortunately, explanations for these trends cannot be proposed with our limitations of appropriate data.

4.6 PROGRAM DATA SUPPORTING NHTSA INVESTIGATIONS

Analyzing the quantity of data produced in the PRP is one method of viewing program performance. The other way is to review the inputs in terms of their contributions to NHTSA investigations. In the past four contract years, CY 76-79, there were17, 17, 15 and 17 cases, respectively, that were supported by the PRP. Exhibit 4.2 lists the cases during the past year that received support from the Parts Return Program.

CASE #	VEHICLE	SUBJECT
C2-53	'67 and later Ford	Dual master cylinder
	'70-'77 Ford Cars	Flex fans
[illegible]0	'70-'77 Fiat	Undercarriage rust
C7-31	'75-'77 British Leyland Vehicles	Ignition system
C7-40	'70-'74 MG Midget	Throttle cable
C8-02	'73-'78 Ford	Transmission linkage
C8-04	'68-'74 Ford Intermed. & Fullsize Cars	Idler arm & Mounting bracket
C8-18	Firestone	Tires
C8-19	'71-'78 Ford Capri	Gear shift lever
C8-20	'75-'77 Ford Granada/Monarch	P/S control valve
C8-24	Broadwheel	Boat trailer wheels
C8-25	'73-'77 Dodge Van	Front disc brakes
C8-29	'73-'75 Ford Pinto	Steering coupling flange
C8-33	1977 GM	V-6 Stalling
C9-01	'74-'77 Ford Trucks	Steering gear bolt
C9-10	'74-'76 VW	Master cylinders
C9-11	Uniroyal	Tires

Cases Supported By the PRP
July 1978 - June 1979

Exhibit 4.2

Section 5

CONCLUSIONS AND RECOMMENDATIONS

The detailed analysis of Section 4 was undertaken in order to offer a baseline for future measurements of program successes and failures. In addition, that analysis offers immediate indications of areas which require attention during the coming contract period.

How effective has the Parts Return Program been over the past four years in terms of input quantity? While total inputs received decreased from CY 1976-78, CY 1979 saw an increase in total inputs, a trend which is expected to continue. Actual parts returned continue to decrease, but information inputs have risen markedly during the past contract year. In addition, more data has been received on recent model year vehicles, especially vehicles one to two years old.

With regard to the repair shop membership, the regional activity level - that is, the percentage of shops within a region which are active during a contract year -- decreased from CY 1976-78 but increased in CY 1979. This corresponds to the increases and decreases seen in inputs received over the four year period. Activity rates, however - the number of inputs received per active shop - showed a decrease over the entire four year period. It is noteworthy in this regard that 50% of all inputs have been submitted by the most active 19 shops while 25% of all inputs have been submitted by the top 5 shops. Hence, activity rates must be carefully monitored in order to preserve an acceptable level of total inputs per year. The critical importance of the top-performing program members also suggests that program success may hinge on the few rather than the many. One resultant strategy would be the cultivation of more shops with characteristics common to the top-performing members.

Program effectiveness in terms of input quality can also be determined by a review of the statistics presented in Section 4. In fact, the number of NHTSA cases supported by the Parts Return Program has remained virtually the same over the past four years - from 15-17 cases.

An increase in input quantity is of primary importance during the coming year of PRP operations. In order to accomplish this, we will need to attend to activity rates as well as to activity levels. The decreasing trend in activity rates must be reversed. We have seen that activity levels are on the increase, yet more is still needed in this area too.

What can we do to increase the effectiveness of the PRP? Unfortunately, we currently lack the information necessary to adequately understand why some members contribute and others do not. In order to explain program effectiveness scientifically and, thus, to manipulate the Program outcomes according to set goals, we need to relate "dependent measures" (e.g., inputs, activity level, activity rate) with "independent variables" (e.g., an enrollment campaign, an incentive program, or an establishment characteristic). For example, to increase the number of inputs we receive, we should know more about who currently contributes and how they are different from the enrollees who do not contribute. Presently, we only know which region and which shop-type category is responsible for a certain contribution. Although this is a beginning, it is not enough to enable us to develop an effective strategy for Program improvement. We need to know more about how the establishments differ that may relate to their participation in the PRP.

KSI makes several recommendations that should affect program effectiveness during the next contract year (CY 1980) and beyond. First, we suggest gathering more information about our new PRP members (as we enroll them) that could help explain their future activity. To affect the activity levels and activity rates, which would directly influence program effectiveness, we propose to initiate a two-stage enrollment campaign and enhance our incentive program.

Activity levels are, we believe, very much a function of the success of enrollments. Few members, as can be seen in Section 4, become active after being enrolled. A two-stage enrollment effort could alter this. The first stage would consist of an initial telephone contact which explains to the prospective member shop what the PRP is about and concludes by asking the shop manager to participate. If the response is positive, then a second stage is undertaken. A formal letter would be mailed to the shop manager which requests that a form be completed specifying certain details about the shop's operation - e.g., number of service bays, type of repair work performed, etc. This would give us more information about shop differences that can be used for more sophisticated analysis in the future which could help explain various aspects of program effectiveness. The shop is asked to return the completed form after having signed it in order to "officially" become a program member. At that time, the shop receives participation materials. This is one way of requiring active interest on the part of the shop before actual enrollment and should guarantee a greater activity level in all regions.

In order to increase activity rates, incentives are needed. These currently include posters, flyers, follow-up telephone calls, certificates of participation, etc. (See Section 2.2.2).

KSI will continue to monitor these incentives, but also proposes to expand in this area. Currently, following enrollment, we interact with our repair shop members on a "personal" basis only when they initiate the contact, either by contributing inputs or requesting materials or information, especially via telephone. We recommend to initiate personal interactions with our membership several times a year. By "personal", we mean an interaction that acknowledges the repair shop's individuality. It would, we believe, be worthwhile to telephone the PRP members during the year and ask them, especially the inactive members, about their current operations and their continuing interest in the PRP. These interactions would be similar to the "follow-up contacts" with our Expansion Study members during the past year (see Volume II). In addition,

we feel it would be effective to occasionally send short letters to all our repair shop members indicating how many inputs we've received from them and if they needed any additional materials. The "personal" notes could be sent along with the PRP News. These contacts are viewed as being reminders, and the telephone contacts in particular are considered important to establish some degree of rapport which should improve membership activity. To study the effects of these incentive methods, we recommend that the proposed additional contacts be initiated in a sample of regions and compared with regions matched in input history but not receiving the additional contacts.

Notes on Statistical Analysis

1. INTRODUCTION TO THE NOTES

Section 4 uses statistical hypothesis testing as a tool to investigate the meaning or significance of data patterns. Statistical hypothesis testing is a method which enables the investigator to test hypotheses he has formulated about data parameters with the test results stated in terms of probabilities. The probabilities for two types of error may be specified: the probability that a hypothesis accepted as true is in fact false and the probability that a hypothesis accepted as false is in fact true. Only the latter type of error will be considered in this Section's statistical analysis. The value of statistical hypothesis testing to the manager is that it controls for the element of random fluctuation in raw data, which may distort the manager's judgement about that raw data's meaning.

Essentially three types of statistical tests will be performed in the Section. The first is Analysis of Variance, and will be used to test the equality of three or more 'categories' means. The "null hypothesis" will be that the means are equal and the "alternate hypothesis" will be that at least one mean is not equal to any other. If the null hypothesis is rejected, Scheffé's method of multiple comparisons or "contrasts" will be used to determine which means are not equal. These Scheffé tests, although not referred to in the text, are presented in the relevant notes (Notes 1-4). Finally, a chi square statistic will be used to test the equality of three or more proportions.

The statistical test procedures are discussed below:

The Analysis of Variance is a method for testing the null hypothesis that the means of K (i.e., a given number of) categories of data are equal against the alternate hypothesis that at least one category's mean is not equal to any

other (a more exact formulation of the null hypothesis is that the data elements constituting each category were drawn from populations with equal means). Use of the Analysis of Variance (ANOVA) requires that the data elements have the properties that they are randomly drawn from populations with homogenous variance. Because of the relative invariance of test results to minor deviations from these assumptions, these assumptions are made for the ANOVA's performed below.

In every case below, the ANOVA model used is single-factor, fixed effects. This model specifies that the ith observation of Y when the jth factor level is operating (Y_{ij}) is given by:

$$Y_{ij} = u + \tau_j + e_{ij}$$

where - u is a constant,

τ_j is called the additive effect of the jth factor level on Y, and e_{ij} is the error of observation i on the jth factor level (e is a random variable that has a normal distribution with mean 0 and standard deviation σ).

Of the assumptions made above, the assumption that the error terms e_{ij} are normally distributed with mean 0 and standard deviation σ has the greatest potential for invalidating the single-factor, fixed effects model for use in analysis of parts return data. The reason is that in every ANOVA below the samples of parts data were made at monthly intervals, with twelve monthly samples for each fiscal year. This introduces the possibility that the error terms e_{ij} are auto-correlated, and thus not random variables as specified as a necessary condition for the model. Inspection of the raw data, however, suggests that if the error terms are correlated (correlated with themselves at lagged intervals in the case of autocorrelation) the lag interval producing a significant correlation coefficient is not less than twelve months. The ANOVAs in Section 4 have sampling intervals that are exactly twelve months, and for this larger balance of ANOVAs auto-correlation should have no effect on their calculations.

Associated with the potential for autocorrelation is the possibility that the monthly sampling intervals themselves have a treatment effect on the Y_{ij}. In this case, the two-factor ANOVA design would be more appropriate. If the monthly intervals do have a differential treatment effect, the removal of that treatment variance from the Error Sum of Squares (see below) would result in a greater likelihood that the null hypothesis would be rejected and, if the null hypothesis was rejected, an increased likelihood that significant differences between means would be found applying Scheffe's method of multiple comparisons. Once again, however, inspection of the raw data suggests neither a pattern to its monthly fluctuation nor a significantly great range between the highest and lowest monthly values. Therefore, the single-factor, fixed effects model will be used for hypothesis testing.

With regard to the nature of the statistical inferences and the actual calculations made in the ANOVA and Scheffé test, refer first to the typical Sum of Squares Summary Table in Note 1. The raw data consisted of twelve rows for the twelve monthly samples and ten columns for the ten regions. The column totals for the raw data matrix, including each column's average value and the average value for all elements (Y_{ij}) in the matrix is given in Table 4.1. for each CY.

Referring to the Sum of Squares Table in Note 1, the ratio between the Mean Sum of Squares for Treatments (MS_T) and the Mean Sum of Squares for Error (MS_E) has a F distribution (assuming the category data elements Y_{ij} are drawn from normally distributed populations). The F distribution is derived from the ratios (s_1^2/s_2^2) between sample variances repeatedly drawn from two populations with equal variance ($\sigma_1^2 = \sigma_2^2$). It can be used, therefore, to test the hypothesis that the variances of two populations are equal. Similarly, MS_T and MS_E are two estimates of the variance of the total population of category data elements. The MS_T estimate of the total population variance is derived from the column means, and if the category data elements are drawn from populations with unequal means MS_T will tend to be larger than MS_E. Thus by using the F distribution to indicate the closeness of the two estimates, MS_T and MS_E, of the total population variance, the closeness of the category means are simultaneously indicated.

When the category data elements are drawn from populations with equal means, the MS_T/MS_E ratio is usually close to 1. Conversely, when the category data elements are drawn from populations with unequal means, the ratio is usually significantly greater than 1. Therefore, to test the null hypothesis that the category means are equal, a test significance level and the number of degrees of freedom are specified to determine a critical value of the F distribution. If the MS_T/MS_E ratio exceeds this critical value, the null hypothesis is rejected.

If the null hypothesis is rejected, the next step in the analysis is to determine which pair of means, or pairs of means, are not equal at the significance level of the F test. It is not possible to test the means a pair at a time using a t test because of the fundamental law of probability which states that if a particular event has a certain probability of occurring when considered individually, the probability of the total set of events occurring is less than or equal to the probability of the single event occurring. Therefore, to test the equality of all possible pairings of means in an ANOVA, simultaneous confidence intervals (for the given significance level of the test) for each pairing must be determined.

Scheffé has derived a value SC_α which gives such a set of simultaneous confidence intervals for a given test significance level. An example of its application is given in Note 1. Scheffé's procedure of multiple contrasts consists first of calculating the differences between all possible combinations of category means in an ANOVA. The value is then added to and subtracted from each difference. If the resultant overall interval (a simultaneous confidence interval) includes zero, the means producing that difference are concluded to be equal at the significance level of the simultaneous confidence intervals. If the overall confidence interval does not include zero, the means are concluded to be not equal.

The third type of statistical test used is derived from the basic chi square statistic. The chi square test will be used to examine hypotheses about the activity levels of independent repair shops enrolled in the Parts Return Program.

It compares the null hypothesis that the activity levels for all categories are equal against the alternate hypothesis that at least one activity level is not equal to any other. If the actual value for X^2 exceeds the critical value of the chi square distribution at the test significance level, the null hypothesis is rejected.

The next section of this appendix presents the formulas of the tests that are used in the notes that follow.

2. STATISTICAL FORMULAS

a) Analysis of Variance (ANOVA)

Summary Table

Source	d.f.	SS	MS	F
Treatments	p-1	SS_T	$SS_T/(p-1)$	MS_T/MS_E
Error	n-p	SS_E	$SS_E/(n-p)$	

$$SS_T = \sum_{i=1}^{p} \frac{T_i^2}{n_i} - n\bar{y}^2$$

$$\text{Total SS} = \sum_{i=1}^{p} \sum_{j=1}^{n_i} y_{ij}^2 - n\bar{y}^2$$

$$SS_E = \text{Total SS} - SS_T$$

b) Scheffé Multiple Comparison Test

Limit Statistic: $(\bar{x}_i - \bar{x}_j) \pm \sqrt{(p-1)\, F_\alpha\, (MS_E)\left(\frac{1}{n_i} + \frac{1}{n_j}\right)}$

c) Chi-Square Statistic (Overall Test)

$$\chi^2 = \frac{1}{\bar{p}\bar{q}} \sum_{i=1}^{m} n_i (p_i - \bar{p})^2 \quad , \quad \text{d.f.} = m-1$$

3. NOTES

Note 1.

Question: Are the regional part inputs in CY 76 significantly different from each other?

Test: Analysis of Variance (ANOVA)

Null Hypothesis (H_0): $R_0 = R_1 = R_2 = \ldots = R_8 = R_9$

Summary Table

Source	d.f.	SS	MS	F	
Treatment	9	2,200	244.44	5.46 ,	$p < .001$
Error	110	4,923	44.75		$\therefore$ reject H_0
					$F_{.05}\ (9,110) = 1.97$
					$F_{.001}\ (9,110) = 3.4$

Total SS = 14,146 - 7,023 = 7,123

SS_T = 9,223 - 7,023 = 2,200

SS_E = 7,123 - 2,200 = 4,923

Conclusion: The Null Hypothesis is rejected, i.e., at least one region is significantly different from the others in terms of parts contributed in CY 76.

Question: Which regions are significantly different?

Test: Scheffé Multiple Comparison Test.

Note 1 (Con't)

$R_9 = 15.75$
$R_6 = 15.08$
$R_5 = 8.50$
$R_1 = 8.17$
$R_2 = 6.83$
$R_4 = 5.75$
$R_0 = 5.00$
$R_3 = 4.83$
$R_8 = 4.75$
$R_7 = 1.83$

R = Regional Part Returns - Monthly Average

Limit Statistic: $(R_i - R_j) \pm \sqrt{9(1.97)\ (44.75)\ (.166)}$

$\pm$ 11.46

$\therefore R_9, R_6 > R_7$

Conclusion: Both Regions 9 and 6 returned significantly more parts than Region 7 in CY 76.

Note 2.

Question: Are the regional part inputs in CY 77 significantly different from each other?

Test: Analysis of Variance (ANOVA)

Null Hypothesis (H_0): $R_0 = R_1 = R_2 = \ldots = R_8 = R_9$

Summary Table

Source	d.f.	SS	MS	F	
Treatment	9	4,933	548	11.44	, $p < .001$
Error	110	5,269	47.9		$\therefore$ reject H_0

$F_{.05}\ (9,110) = 1.97$

$F_{.001}\ (9,110) = 3.4$

Conclusion: The Null Hypothesis is rejected.

Question: Which regions are significantly different?

Test: Scheffé Multiple Comparison Test.

$R_9 = 24.67$
$R_1 = 16.75$
$R_5 = 14.92$
$R_0 = 12.08$
$R_6 = 11.12$
$R_2 = 7.75$
$R_8 = 6.67$
$R_4 = 5.50$
$R_3 = 3.75$
$R_7 = 3.00$

R = Regional Part Returns - Monthly Average

Limit Statistic: $(R_i - R_j) \pm \sqrt{9\ (1.97)\ (47.9)\ (.166)}$

$\pm\ 11.85$

$\therefore\ R_9 > R_0, R_6, R_2, R_8, R_4, R_3, R_7$

$R_9, R_1 > R_3, R_7$

$R_9, R_1, R_5 > R_7$

Conclusion: Region 9 returned significantly more parts in CY 77 than Region 0 and all other regions below it in the hierarchy. Region 1 contributed more than Regions 3 & 7. Region 5 more than Region 7.

Note 3.

Question: Are the regional part inputs in CY 78 significantly different from each other?

Test: Analysis of Variance (ANOVA)

Null Hypothesis (H_0): $R_0 = R_1 = R_2 = \ldots R_8 = R_9$

Summary Table

Source	d.f.	SS	MS	F	
Treatment	9	1,122	125	5.66 ,	$p < .001$
Error	110	2,424	22		$\therefore$ reject H_0
					$F_{.001}\ (9,100) = 3.4$

Conclusion: The Null Hypothesis is rejected.

Question: Which regions are significantly different?

Test: Scheffé Multiple Comparison Test.

$R_0 = 11.58$
$R_9 = 10.00$
$R_5 = 9.58$
$R_1 = 7.08$
$R_2 = 6.33$
$R_8 = 5.17$
$R_6 = 4.58$
$R_3 = 3.58$
$R_4 = 3.17$
$R_7 = 2.00$

R = Regional Part Returns - Monthly Average

Limit Statistic: $(R_i - R_j) \pm \sqrt{9\ (1.97)\ (22)\ (.166)}$

$\pm\ 8.04$

$\therefore R_0 > R_4, R_7$

Conclusion: Region 0 returned significantly more parts in CY 78 than Regions 4 and 7.

Note 4.

Question: Are the regional part inputs in CY 79 significantly different from each other?

Test: ANOVA

H_0: $R_0 = R_1 = R_2 = \ldots = R_8 = R_9$

Summary Table

Source	d.f.	SS	MS	F	
Treatment	9	978	108.7	5.17	, $p < .001$
Error	110	2,310	21		$\therefore$ reject H_0

Conclusion: The Null Hypothesis is rejected.

Question: Which regions are significantly different?

Test: Scheffé Multiple Comparison Test.

$R_9 = 10.50$
$R_1 = 9.33$
$R_5 = 6.08$
$R_2 = 5.92$
$R_0 = 5.58$
$R_8 = 4.67$
$R_6 = 4.00$
$R_3 = 3.67$
$R_4 = 1.67$
$R_7 = 0.92$

R = Regional Part Returns - Monthly Average

Limit Statistic: $(R_i - R_j) \pm \sqrt{9\ (1.97)\ (21)\ (.166)}$

$\pm \quad 7.85$

$\therefore R_9 > R_4, R_7$

$R_1 > R_7$

Conclusion: Region 9 returned significantly more parts in CY 79 than Regions 4 and 7. Region 1 contributed more than Region 7.

Note 5.

Question: Are the activity levels (AL) in the contract years CY 76 - CY 79 significantly different such that at least one proportion is not derived from the same population as the others?

Test: Chi-Square

Null Hypothesis (H_0): $p76 = p77 = p78 = p79$

Annual AL Proportions	Number Enrolled	$n_i (p_i - \bar{p})^2$
$p76 = .181$	$n76 = 1851$	4.44
$p77 = .130$	$n77 = 1795$	0.01
$p78 = .104$	$n78 = 1824$	1.43
$p79 = .114$	$n79 = 1813$	0.59
		$\Sigma = 6.47$

$\bar{p} = .132$
$\bar{q} = .868$

$$X^2 = \frac{1}{.115} (6.47) = 56.3 \quad , \quad p < .005$$

Conclusion: Reject H_0 , i.e., all the sample proportions do not come from the same population.

Note 6.

Question: Are the activity levels (AL) of regions in CY 76 significantly different?

Test: Chi-Square

Null Hypothesis (H_0): $p0 = p1 = p2 = \ldots = p8 = p9$

Regional AL Proportions	Enrollees	$n_i (p_i-\bar{p})^2$
p9 = .265	230	1.62
p5 = .216	153	0.19
p0 = .216	134	0.16
p1 = .201	224	0.09
p6 = .169	183	0.03
p4 = .153	216	0.17
p2 = .149	222	0.23
p8 = .148	169	0.18
p3 = .147	170	0.20
p7 = .133	150	0.35
$\bar{p}$ = .181	Σ =	3.22
$\bar{q}$ = .819		

$$X^2 = \frac{1}{.148} (3.22) = 21.8 , \quad p < .025$$

Conclusion: Reject H_0.

Note 7.

Question: Are the activity levels (AL) of regions in CY 77 significantly different?

Test: Chi-Square

H_0: p0 = p1 = ... = p8 = p9

Regional AL Proportions	Enrollees	$n_j (p_j - \bar{p})^2$
p9 = .217	189	1.40
p5 = .174	144	0.27
p0 = .148	149	0.04
p1 = .132	287	0.00
p6 = .123	162	0.01
p3 = .119	101	0.01
p7 = .108	148	0.08
p8 = .106	217	0.14
p4 = .096	188	0.23
p2 = .090	210	0.35
		$\sum$ = 2.53

$\bar{p}$ = .131

$\bar{q}$ = .869

$$X^2 = \frac{1}{.114}(2.53) = 22.2 \quad , \quad p < .01$$

Conclusion: Reject H_0.

Note 8.

Question: Are the activity levels (AL) of regions in CY 78 significantly different?

Test: Chi-Square

H_0: p0 = p1 = ... = p8 = p9

Regional AL Proportions	Enrollees	$n_i (p_i-\bar{p})^2$
p9 = .163	190	.639
p5 = .130	193	.121
p0 = .120	142	.032
p3 = .109	137	.002
p4 = .102	118	.001
p6 = .101	199	.003
p1 = .100	261	.007
p2 = .079	202	.137
p8 = .078	245	.179
p7 = .066	137	.208
		Σ = 1.32

$\bar{p}$ = .105

$\bar{q}$ = .895

$$X^2 = \frac{1}{.094}(1.32) = 14.14 \quad , \quad p > .1$$

Conclusion: Accept H_0, i.e., the differences among the activity levels were not statistically significant.

Note 9.

Question: Are the activity levels (AL) of regions in CY 79 significantly different?

Test: Chi-Square

H_0: p0 = p1 = ... = p8 = p9

Regional AL Proportions	Enrollees	$n_i (p_i-\bar{p})^2$
p0 = .175	137	.477
p1 = .156	244	.390
p4 = .138	87	.042
p5 = .120	191	.003
p3 = .113	150	.001
p9 = .107	205	.017
p6 = .103	195	.033
p8 = .101	238	.054
p7 = .077	143	.218
p2 = .072	223	.432
		$\sum$ = 1.67

$\bar{p}$ = .116

$\bar{q}$ = .884

$$X_2 = \frac{1}{.103} (1.67) = 16.2 \quad , \quad p > .05$$

Conclusion: Accept H_0.

Note 10.

Question: Are the activity levels (AL) of General Repair Garages significantly different across the years CY 77 - CY 79?

Test: Chi-Square

H_0: p77 = p78 = p79

Annual AL Proportions	Enrollees	$n_i (p_i-\bar{p})^2$
p77 = .119	1154	.057
p78 = .105	1145	.056
p79 = .111	1177	.001
$\bar{p}$ = .112		Σ = .114
$\bar{q}$ = .888		

$$X^2 = \frac{1}{.099}(.114) = 1.15 \quad , \quad p > .05$$

Conclusion: Accept H_0.

Note 11.

Question: Are the activity levels (AL) of Special Repair Garages significantly different across the years CY 77 - CY 79?

Test: Chi-Square

H_0: p77 = p78 = p79

Annual AL Proportions	Enrollees	$n_i (p_i-\bar{p})^2$
p77 = .182	275	.054
p78 = .174	259	.009
p79 = .146	245	.119
$\bar{p}$ = .168		Σ = .182
$\bar{q}$ = .832		

$$X^2 = \frac{1}{.140} (.182) = 1.30 , \quad p > .05$$

Conclusion: Accept H_0.

Note 12.

Question: Are the activity levels (AL) of Service Stations significantly different across the years CY 77 - CY 79?

Test: Chi-Square

H_0: p77 = p78 = p79

Annual AL Proportions	Enrollees	$n_i (p_i-\bar{p})^2$
p77 = .099	314	.113
p78 = .056	323	.186
p79 = .085	318	.008
		Σ = .307
$\bar{p}$ = .080		
$\bar{q}$ = .920		

$$X^2 = \frac{1}{.074} (.307) = 4.15, \quad p > .05$$

Conclusion: Accept H_0.

Note 13.

Question: Are the activity levels (AL) of General Repair Garages, Special Repair Garages and Service Stations significantly different in CY 77?

Test: Chi-Square

H_0: pGRG = pSRG = pSS

Shop AL Proportions	Enrollees	$n_i (p_i-\bar{p})^2$
pGRG = .119	1154	.042
pSRG = .182	275	.893
pSS = .098	314	.229
		$\sum$ = 1.16

$\bar{p}$ = .125

$\bar{q}$ = .875

$$X^2 = \frac{1}{.109}(1.16) = 10.68 \ , \quad p < .01$$

Conclusion: Reject H_0.

Note 14.

Question: Are the activity levels (AL) of General Repair Garages, Special Repair Garages and Service Stations significantly different in CY 78?

Test: Chi-Square

H_0: pGRG = pSRG = pSS

Shop AL Proportions	Enrollees	$n_i (p_i-\bar{p})^2$
pGRG = .105	1145	0.00
pSRG = .174	259	1.20
pSS = .056	323	0.81
		Σ = 2.01
$\bar{p}$ = .106		
$\bar{q}$ = .894		

$$X^2 = \frac{1}{.095}(2.01) = 21.2 , \quad p < .005$$

Conclusion: Reject H_0.

Note 15.

Question: Are the activity levels (AL) of General Repair Garages, Special Repair Garages and Service Stations significantly different in CY 79?

Test: Chi-Square

H_0: pGRG = pSRG = pSS

Shop AL Proportions	Enrollees	$n_i (p_i-\bar{p})^2$
pGRG = .111	1177	.005
pSRG = .146	245	.335
pSS = .085	318	.183
		Σ = .523
$\bar{p}$ = .109		
$\bar{q}$ = .891		

$$X^2 = \frac{1}{.097} (.523) = 5.39 , \quad p > .05$$

Conclusion: Accept H_0.

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